

The Cancer Burden of Linn County



Public Health
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Linn County, Iowa

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Table of Contents

Introduction.....	6
All Sites.....	6
<i>Trends.....</i>	<i>6</i>
<i>Sex.....</i>	<i>7</i>
<i>Age.....</i>	<i>8</i>
<i>Race.....</i>	<i>10</i>
<i>Geospatial Analysis.....</i>	<i>12</i>
Top Ten Cancer Types.....	17
<i>Trends.....</i>	<i>17</i>
<i>Sex.....</i>	<i>18</i>
Breast Cancer.....	19
<i>Trends.....</i>	<i>19</i>
<i>Sex.....</i>	<i>20</i>
<i>Age.....</i>	<i>21</i>
<i>Race.....</i>	<i>22</i>
<i>Staging.....</i>	<i>23</i>
<i>Geospatial Analysis.....</i>	<i>24</i>
Lung and Bronchus Cancer.....	26
<i>Trends.....</i>	<i>26</i>
<i>Sex.....</i>	<i>27</i>
<i>Age.....</i>	<i>27</i>
<i>Race.....</i>	<i>28</i>
<i>Staging.....</i>	<i>29</i>
<i>Geospatial Analysis.....</i>	<i>30</i>
Prostate Cancer.....	32
<i>Trends.....</i>	<i>32</i>
<i>Age.....</i>	<i>32</i>

Table of Contents (cont.)

<i>Race</i>	33
<i>Staging</i>	35
<i>Geospatial Analysis</i>	35
Colorectal Cancer	37
<i>Trends</i>	37
<i>Sex</i>	37
<i>Age</i>	38
<i>Race</i>	39
<i>Staging</i>	40
<i>Geospatial Analysis</i>	41
Skin Cancer	41
<i>Trends</i>	41
<i>Sex</i>	43
<i>Age</i>	43
<i>Race</i>	44
<i>Staging</i>	46
<i>Geospatial Analysis</i>	46
Recommendations	48

Table of Figures

Figure 1. Age-adjusted incidence rate, all sites, 2000-2013.....	7
Figure 2. Percent of newly diagnosed cancer cases, Linn County, by sex, 2000-2013.....	8
Figure 3. Percent of population, Linn County, by age group, 2010.....	9
Figure 4. Percent of newly diagnosed cancer cases, Linn County, by age, 2000-2013.....	9
Figure 5. Age-adjusted incidence rates, Linn County, by age group, 2000-2013.....	10
Figure 6. Cancer staging all sites, Linn County, by age group, 2000-2013.....	10
Figure 7. Percent of newly diagnosed cancer cases, Linn County, by race, 2000-2013.....	11
Figure 8. Age-adjusted incidence rates, by race, 2009-2013.....	12
Figure 9. Age-adjusted incidence rates, Linn County, by race and sex, 2009-2013.....	12
Figure 10. Population distribution of Linn County, IA, by census tract, 2010 census.....	13
Figure 11. Population distribution of Linn County, IA, by census tract and race, 2010 census.....	14
Figure 12. Population distribution of Linn County, IA, by census tract and race, 2010 census.....	15
Figure 13. All cancer incidence distribution of Linn County, IA, by census tract, 2010 census.....	16
Figure 14. Percent of newly diagnosed cancers, Linn County, by type, 2000-2013.....	17
Figure 15. Age-adjusted incidence rates, Linn County, by type, 2000-2013.....	18
Figure 16. Age-adjusted incidence rates, Linn County, by sex and type, 2000-2013.....	18
Figure 17. Age-adjusted incidence rates, Linn County, males by type, 2000-2013.....	19
Figure 18. Age-adjusted incidence rates, Linn County, females by type, 2000-2013.....	19
Figure 19. Age-adjusted incidence rates, breast (female) cancer, 2000-2013.....	20
Figure 20. Percent of newly diagnosed cancer cases, Linn County, breast cancer, by sex, 2000-2013.....	21
Figure 21. Percent of newly diagnosed female breast cancer, Linn County, by age, 2000-2013.....	22
Figure 22. Age-adjusted incidence rates, Linn County, female breast cancer, by age group, 2000-2013.....	22
Figure 23. Age-adjusted incidence rates, Linn County, female breast cancer, by race, 2009-2013.....	23
Figure 24. Percent of newly diagnosed female breast cancer, Linn County, by race, 2000-2013.....	23
Figure 25. Female breast cancer staging, Linn County, by race, 2000-2013.....	24
Figure 26. Breast cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census.....	25

Table of Figures (cont.)

Figure 27. Age-adjusted incidence rates, lung and bronchus cancer, 2000-2013.....	26
Figure 28. Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by sex, 2000-2013.....	27
Figure 29. Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by age group, 2000-2013.....	28
Figure 30. Age-adjusted incidence rates, Linn County, lung and bronchus cancer, by age group, 2000-2013.....	28
Figure 31. Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by race, 2000-2013.....	29
Figure 32. Age-adjusted incidence rates, Linn County, lung and bronchus cancer, by race, 2009-2013....	29
Figure 33. Lung and bronchus cancer staging, Linn County, by race, 2000-2013.....	30
Figure 34. Lung and bronchus cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census.....	31
Figure 35. Age-adjusted incidence rates, prostate cancer, 2000-2013.....	32
Figure 36. Percent of newly diagnosed cancer cases, Linn County, prostate cancer, by age group, 2000-2013.....	33
Figure 37. Age-adjusted incidence rates, Linn County, prostate cancer, by age group, 2000-2013.....	33
Figure 38. Percent of newly diagnosed cancer cases, Linn County, prostate cancer, by race, 2000-2013.....	34
Figure 39. Age-adjusted incidence rates, Linn County, prostate cancer, by race, 2009-2013.....	34
Figure 40. Prostate cancer staging, Linn County, by race, 2000-2013.....	35
Figure 41. Prostate cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census.....	36
Figure 42. Age-adjusted incidence rates, colorectal cancer, 2000-2013.....	37
Figure 43. Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by sex, 2000-2013.....	38
Figure 44. Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by age group, 2000-2013.....	38
Figure 45. Age-adjusted incidence rates, Linn County, colorectal cancer, by age group, 2000-2013.....	39
Figure 46. Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by race, 2000-2013.....	39

Table of Figures (cont.)

Figure 47. Age-adjusted incidence rates, Linn County, colorectal cancer, by race, 2009-2013.....	40
Figure 48. Colorectal cancer staging, Linn County, by race, 2000-2013.....	40
Figure 49. Colorectal cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census.....	42
Figure 50. Age-adjusted incidence rates, skin cancer, 2000-2013.....	43
Figure 51. Percent of newly diagnosed cancer cases, Linn County, skin cancer, by sex, 2000-2013.....	43
Figure 52. Percent of newly diagnosed cancer cases, Linn County, skin cancer, by age group, 2000-2013.....	44
Figure 53. Age-adjusted incidence rates, Linn County, skin cancer, by age group, 2000-2013.....	44
Figure 54. Percent of newly diagnosed cancer cases, Linn County, skin cancer, by race, 2000-2013.....	45
Figure 55. Age-adjusted incidence rates, Linn County, skin cancer, by race, 2009-2013.....	45
Figure 56. Skin cancer staging, Linn County, by race, 2000-2013.....	46
Figure 57. Skin cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census.....	47

Introduction

Cancer is the second leading cause of death in the United States and, along with heart disease, which is the leading cause of death, accounts for approximately 50% of all deaths each year¹. In Linn County cancer is the leading cause of death². Many risk factors have been associated with increased risk of developing cancer including: smoking, alcohol use, obesity, age, race and sex. While some risk factors cannot be changed, such as age, race and sex, many are lifestyle choices that can be amended, such as smoking or alcohol use¹. Proper screening, as recommended by the U.S. Preventive Services Task Force, of breast, cervical, colorectal and lung cancers has been shown to help reduce and prevent cancer onset and death from these types of cancers³. Certain vaccines, such as the human papilloma (HPV) which prevents most cervical cancers as well as lowers the risk for many other cancer types and hepatitis B (HBV) which lowers the risk for liver cancer, have been shown to reduce cancer risk as well¹. In 2010, according to the National Institutes of Health, cancer cost the United States approximately \$124 billion in direct medical costs and is projected to cost \$157 billion by 2020⁴. In an effort to describe the cancer burden of Linn County this report will utilize cancer incidence data from the State Health Registry of Iowa (SHRI), through a data sharing agreement with the Iowa Department of Public Health (IDPH). The SHRI is one of 18 Surveillance, Epidemiology and End Results (SEER) registries throughout the United States as well as one of the original 9 SEER registries. The other SEER registries are located in San Francisco, Connecticut, Detroit, Hawaii, New Mexico, Seattle, Utah, Atlanta, San Jose-Monterey, Los Angeles, Alaska Native Registry, Rural Georgia, Greater California, Kentucky, Louisiana, New Jersey and Greater Georgia. SEER breaks down its data into five categories based on the SEER registries and their entrance into the program. The groupings include SEER 9, SEER 11, SEER 13, SEER 17 and SEER 18 and the data ranges from 1973-2013. The SEER registries collect and compare cancer incidence and mortality data allowing for estimation of the nation's cancer burden.

All Sites

Trends

The overall trend in cancer incidence in Linn County has been slowly decreasing since 2000. In the year 2000, the overall incidence rate for all cancer sites was 537.9 cases per 100,000. In 2013 that rate was down to 507.2 per 100,000, which accounted for a 6% decrease in overall cancer incidence in Linn County, but this decrease was not statistically significant (Figure 1). While the rate for Linn County is decreasing it is still higher than both the rate of Iowa as a whole and the SEER 13 combined data (Figure 1).

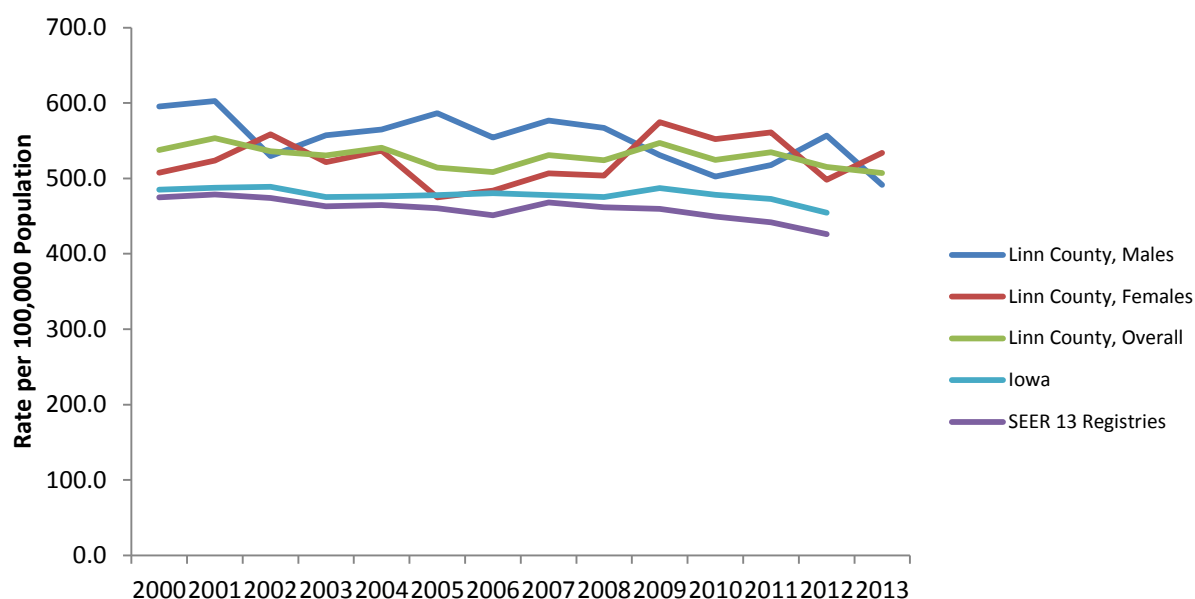
¹ Centers for Disease Control and Prevention. Cancer Prevention and Control. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/index.htm>

² Linn County Public Health. The Health of Linn County, Iowa: A county-wide assessment of health status and health risks. Cedar Rapids, IA: Linn County Public Health. July 2014.

³ *Recommendations for Primary Care Practice*. U.S. Preventive Services Task Force. January 2016. <http://www.uspreventiveservicestaskforce.org/Page/Name/recommendations>

⁴ Mariotto AB, Yabroff KR, Shao Y, Feuer EJ, Brown ML. Projections of the Cost of Cancer Care in the U.S.: 2010-2020. J Natl Cancer Inst. 2011 Jan.

Figure 1: Age-adjusted incidence rate, all sites, 2000-2013



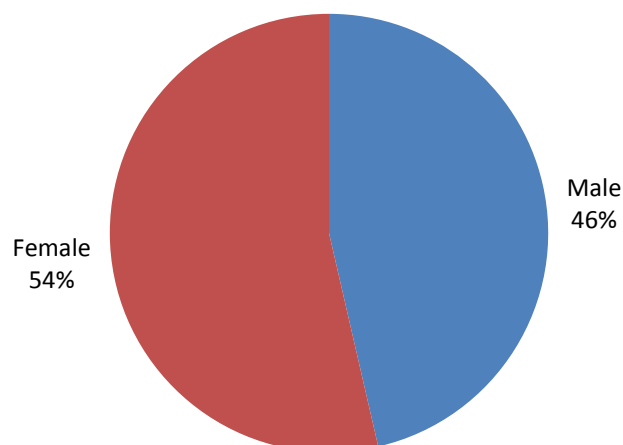
Source: State Health Registry of Iowa, National Cancer Institute

Sex

The downward trend seen in the overall cancer incidence rate holds true for the male population of Linn County. In 2000, the incidence rate for all cancer sites in males was 595.3 per 100,000 and in 2013 that rate was drastically reduced to 491.3 per 100,000, which accounted for a statistically significant decrease of 17%. In women, this trend is reversed with the rate increasing from 2000-2013. In 2000, the cancer incidence rate for women was 507.4 per 100,000 and in 2013 that rate was 533.7 per 100,000, which accounted for a 5% increase since 2000. For women there was a statistically significant increase of 18% during the years 2005-2011. The sex distribution in Linn County is nearly even as 49% of the population is male and 51% is female⁵. While demographically the sex distribution is nearly 50/50, in terms of cancer burden it is not. Of all newly diagnosed cases from 2000-2013, 54% were diagnosed in women with only 46% being diagnosed in men (Figure 2). Two female specific cancer types, female breast and endometrial, accounted for nearly 20% of newly diagnosed cancers from 2000-2013, whereas one male specific cancer, prostate, only accounted for 10% of new cases (Figure 9).

⁵ U.S. Census Bureau; Census 2010, Summary File 1, Table DP-1; Generated by Scott Seltrecht; using American Factfinder; < <http://factfinder.census.gov>>; (14 March 2016).

Figure 2: Percent of newly diagnosed cancer cases, Linn County, by sex, 2000-2013



Source: State Health Registry of Iowa

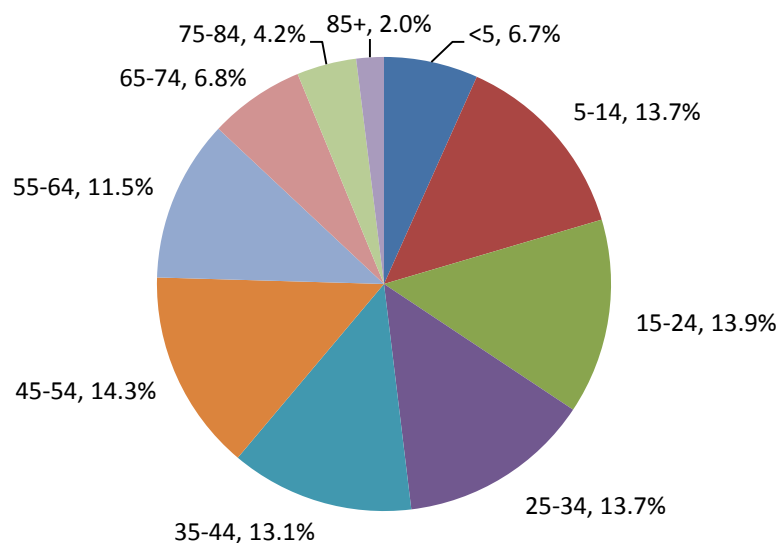
Age

According to the most recent US census in 2010, the population distribution in Linn County is nearly evenly distributed between the ages of 5-64. The very young, <5 years old, and the older population, >64 years old, make up a smaller proportion of the population of Linn County (Figure 3). The cancer burden of Linn County disproportionately affects the older community, with nearly 90% of all newly diagnosed cancers occurring in individuals over the age of 45, and approximately 65% of those cases occurring between the ages of 55-84, which is striking as 22% of the population of Linn County accounts for 65% of all new cancer cases (Figure 4). This disproportionality can also be seen in the overall cancer incidence rate by age group from 2000-2013, with the overall cancer incidence rate jumping from 13.2 per 100,000 in 25-34 year olds to 133.2 per 100,000 in 65-74 year olds, which is the highest rate of any age group (Figure 5). These trends in Linn County closely mirror the trends seen in Iowa and in the SEER 18 registries combined datasets, with the average age of cancer diagnosis at 65 years old nationally⁶. While the majority of new cancer cases in Linn County are discovered earlier in the course of disease, with nearly 42% of new cancers staged as “localized” or “limited to the organ of origin”, almost half of new cancers in the extremely young, <5 years of age, are staged as “distant” or “a tumor that has spread to areas of the body distant or remote from the primary tumor”⁷ (Figure 6).

⁶ Fast Stats: An interactive tool for access to SEER cancer statistics. All Cancer Sites. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

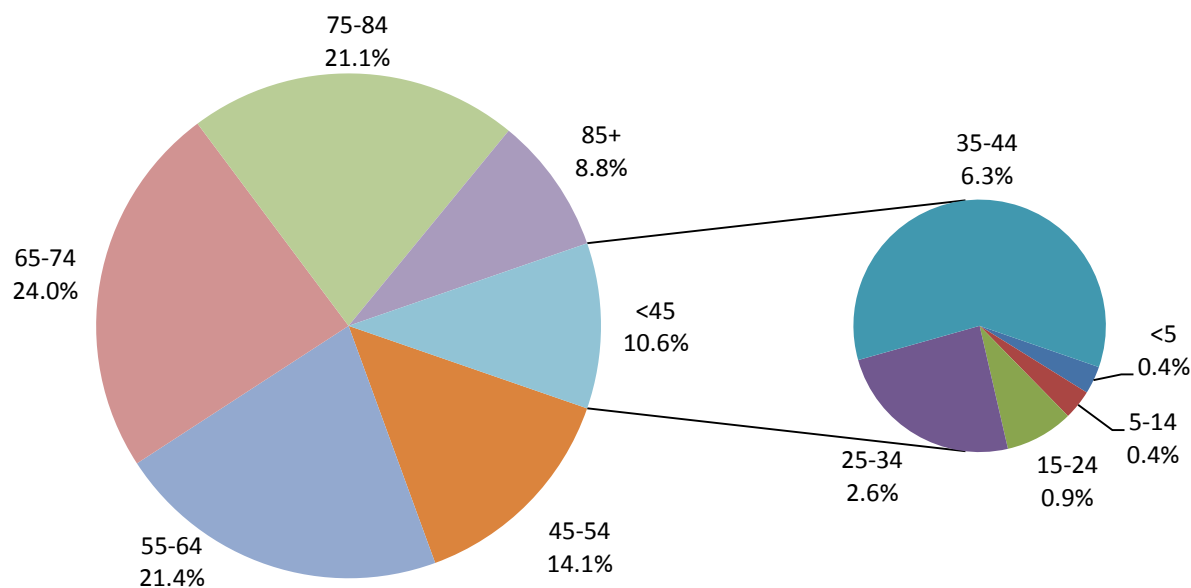
⁷ SEER Training Modules, *ICD-O-3 Site Codes*. U. S. National Institutes of Health, National Cancer Institute. 14 March 2016 <<http://training.seer.cancer.gov/>>.

Figure 3: Percent of population, Linn County, by age group, 2010



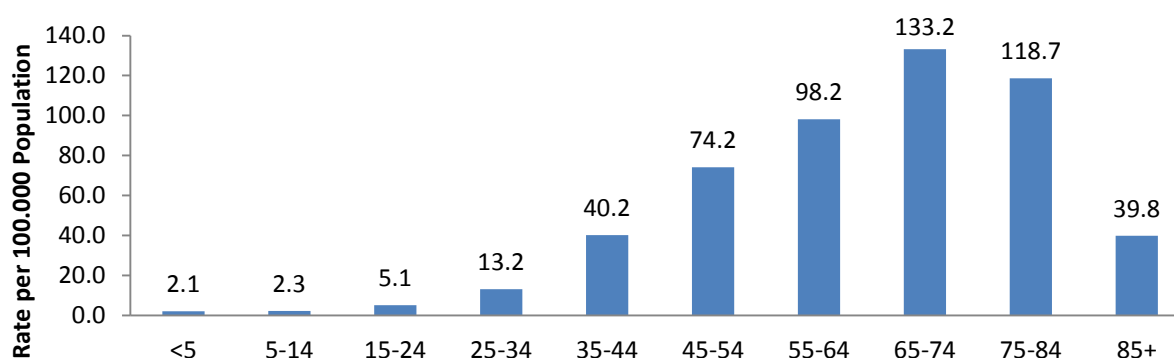
Source: US Census Bureau, 2010 Census

Figure 4: Percent of newly diagnosed cancer cases, Linn County, by age, 2000-2013



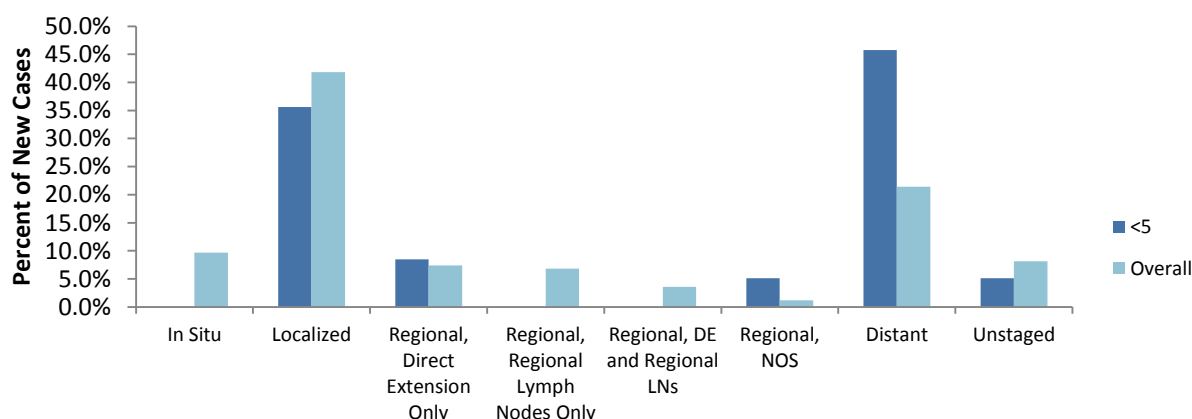
Source: State Health Registry of Iowa

Figure 5: Age-adjusted incidence rates, Linn County, by age group, 2000-2013



Source: State Health Registry of Iowa

Figure 6: Cancer staging all sites, Linn County, by age group, 2000-2013



Source: State Health Registry of Iowa

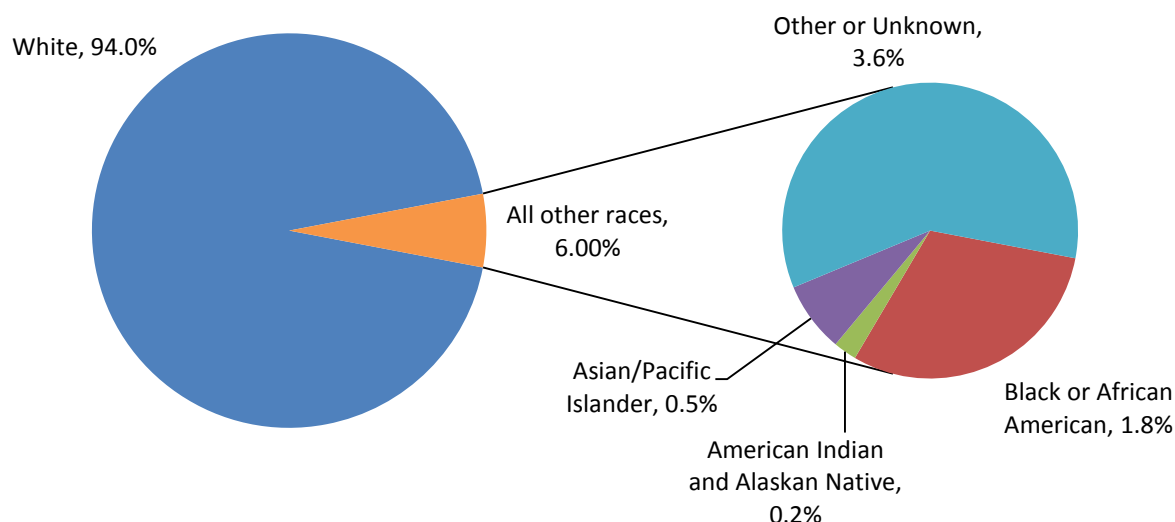
Race

According to the most recent US census in 2010, 90.8% of the population of Linn County is White, 4.0% is Black or African American, 0.3% is American Indian or Alaskan Native, 1.9% is Asian or Pacific Islander, and 3.0% is a combination of the above races or identifies as some other race⁸. This distribution of race in Linn County is mirrored in the distribution of cancer incidence. 94% of newly diagnosed cancer between the years of 2000-2013 occurred in the White population, 1.8% in the Black or African American population, 0.2% in the American Indian or Alaskan Native population and 0.5% in the Asian or Pacific Islander population (Figure 7). Due to a lack of accurate population estimates and low counts making calculations of accurate incidence rates infeasible the American Indian or Alaskan Native and Asian or Pacific Islander populations will be excluded from further analysis. These issues also affect our ability to accurately report data from 2000-2008 for the Black or African American community. Due to this all reporting of age-adjusted cancer incidence rates for the Black or African

⁸ U.S. Census Bureau; Census 2010, Summary File 1, Table DP-1; Generated by Scott Seltrecht; using American Factfinder; < <http://factfinder.census.gov>>; (14 March 2016).

American community will only include the years of 2009-2013, and may omit some of those years due to low incidence counts.

Figure 7: Percent of newly diagnosed cancer cases, Linn County, by race, 2000-2013



Source: State Health Registry of Iowa

Since 2009 the cancer incidence rate in both the White and Black or African American populations of Linn County have been decreasing, but are still consistently above both the rates for Iowa as a whole and the combined data of the SEER 13 registries (Figure 8). The Black or African American population of Linn County has a higher incidence rate of cancer at all sites than the White population for every year between 2009-2013 with the difference between both races becoming as large as 213.4 per 100,000 in 2011. In that year the overall incidence rate for the Black or African American population was 728.5 per 100,000 as compared to 515.1 per 100,000 for the White population of Linn County (Figure 8). This trend is further exemplified when stratifying by sex (Figure 9). Again, the Black or African American population consistently has a higher incidence rate in both the male and female population as compared to the White population. Due to low incidence counts, stable incidence rates for Black or African American males in 2009 and 2010 could not be calculated therefore those years were suppressed and not reported in this analysis.

Figure 8: Age-adjusted incidence rates, by race, 2009-2013

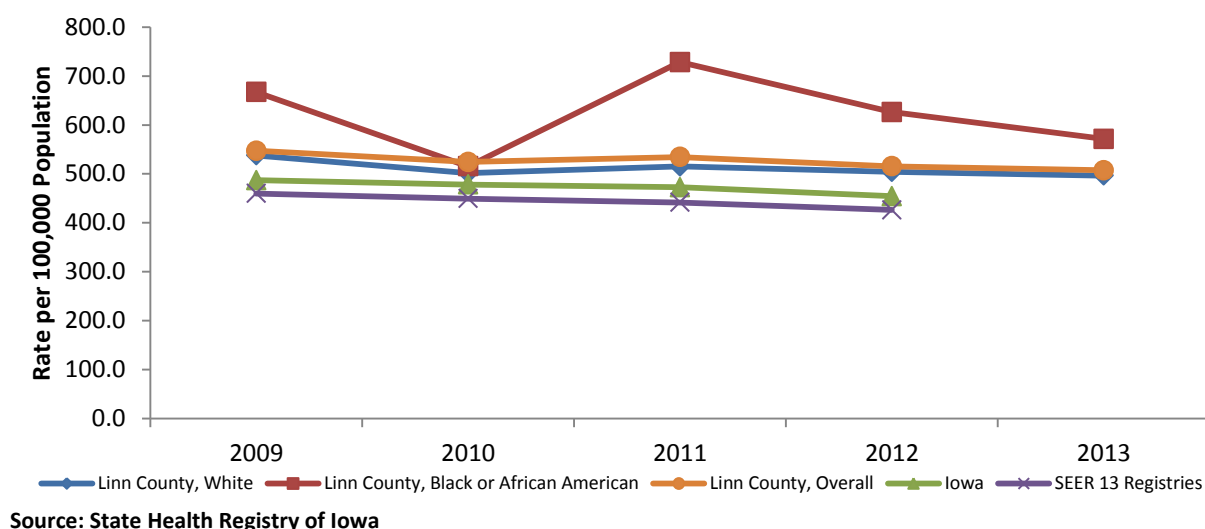
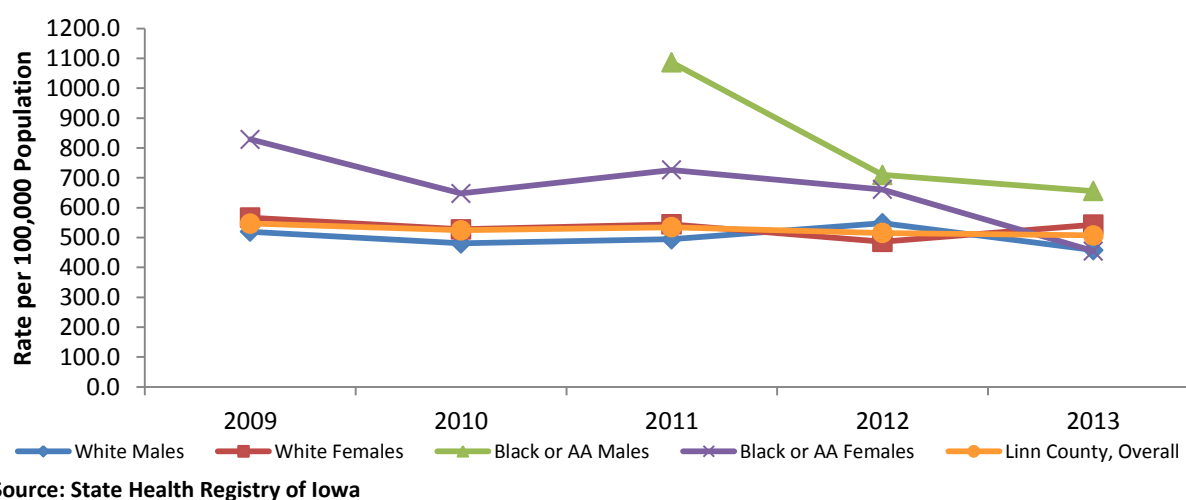


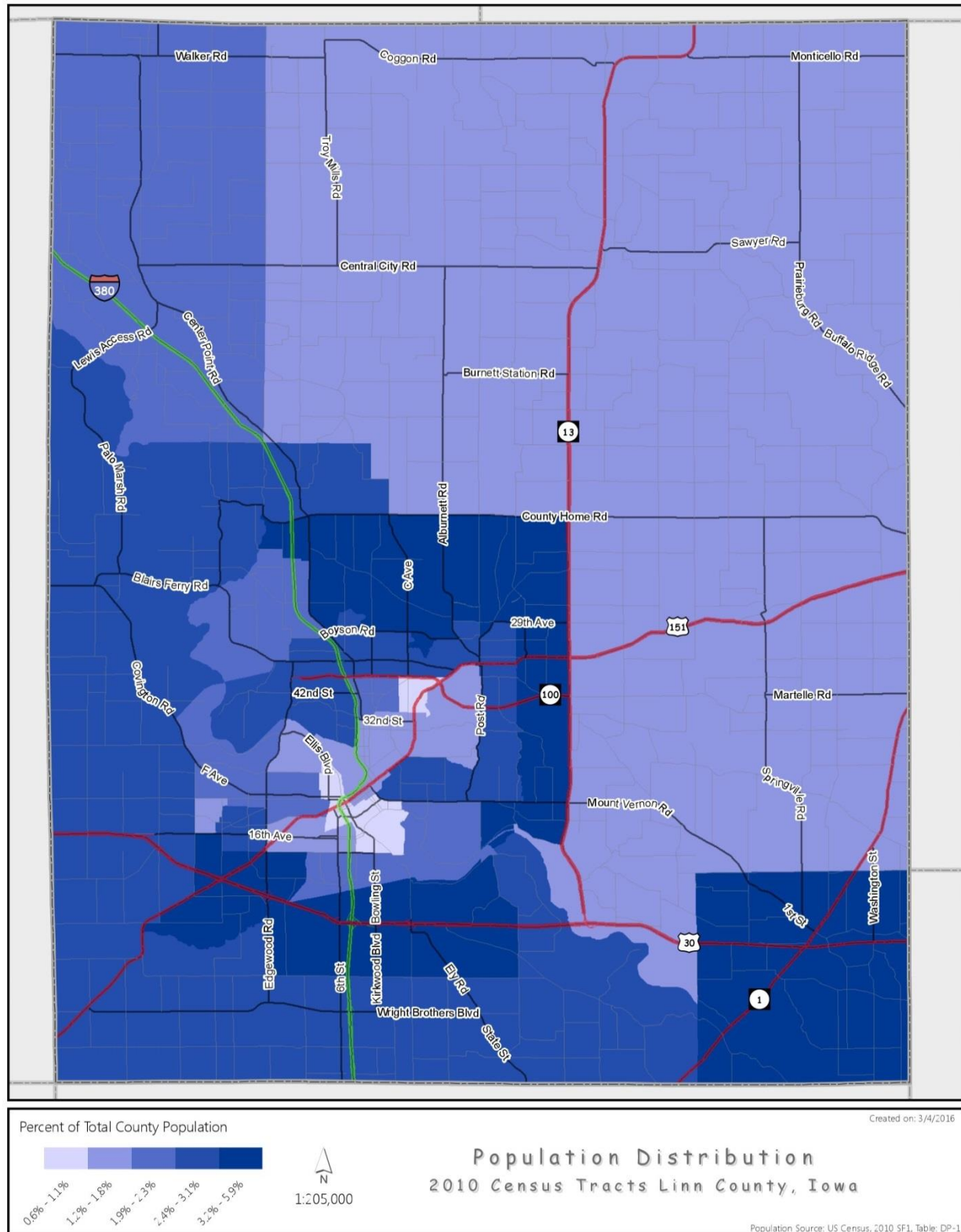
Figure 9: Age-adjusted incidence rates, Linn County, by race and sex, 2009-2013



Geospatial Analysis

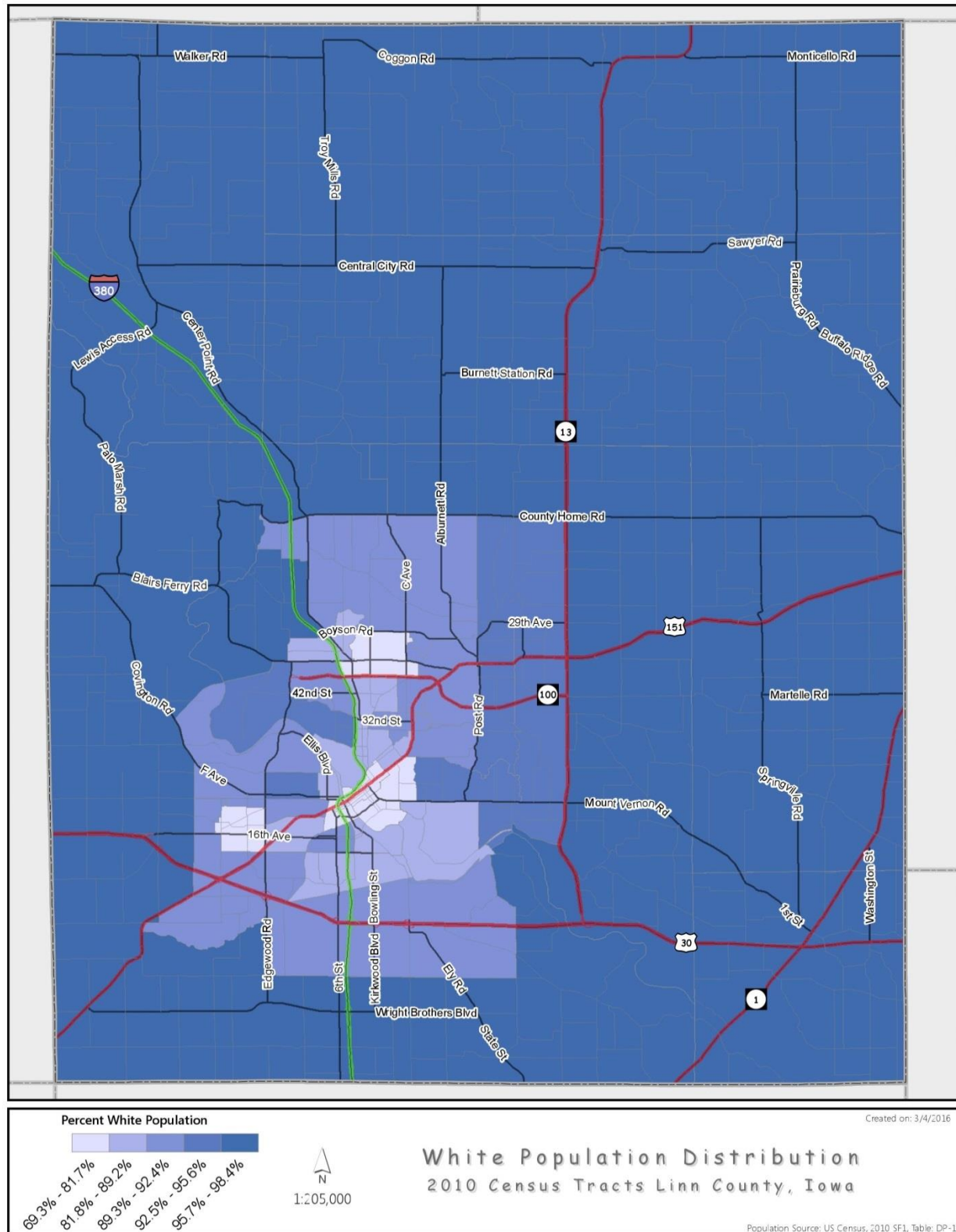
The population distribution of Linn County centers mostly in the suburban areas of Cedar Rapids, Hiawatha, Marion and Mt. Vernon (Figure 10). The distribution of the White population closely mirrors the total population distribution, with the majority of the White population of Linn County residing in the suburban areas around Cedar Rapids and the rural portions of Linn County (Figure 11). Inversely the Black or African American population of Linn County is almost completely concentrated in the Cedar Rapids metro area (Figure 12). The map of overall cancer incidence over the years 2000-2013 shows areas of increased incidence within Linn County. The Cedar Rapids metro area and the northeastern/eastern rural portions of Linn County have higher incidence rates of all cancer types as compared to the rest of Linn County (Figure 13). These areas differ from each other by race distribution and population concentration.

Figure 10: Population distribution of Linn County, IA, by census tract, 2010 census



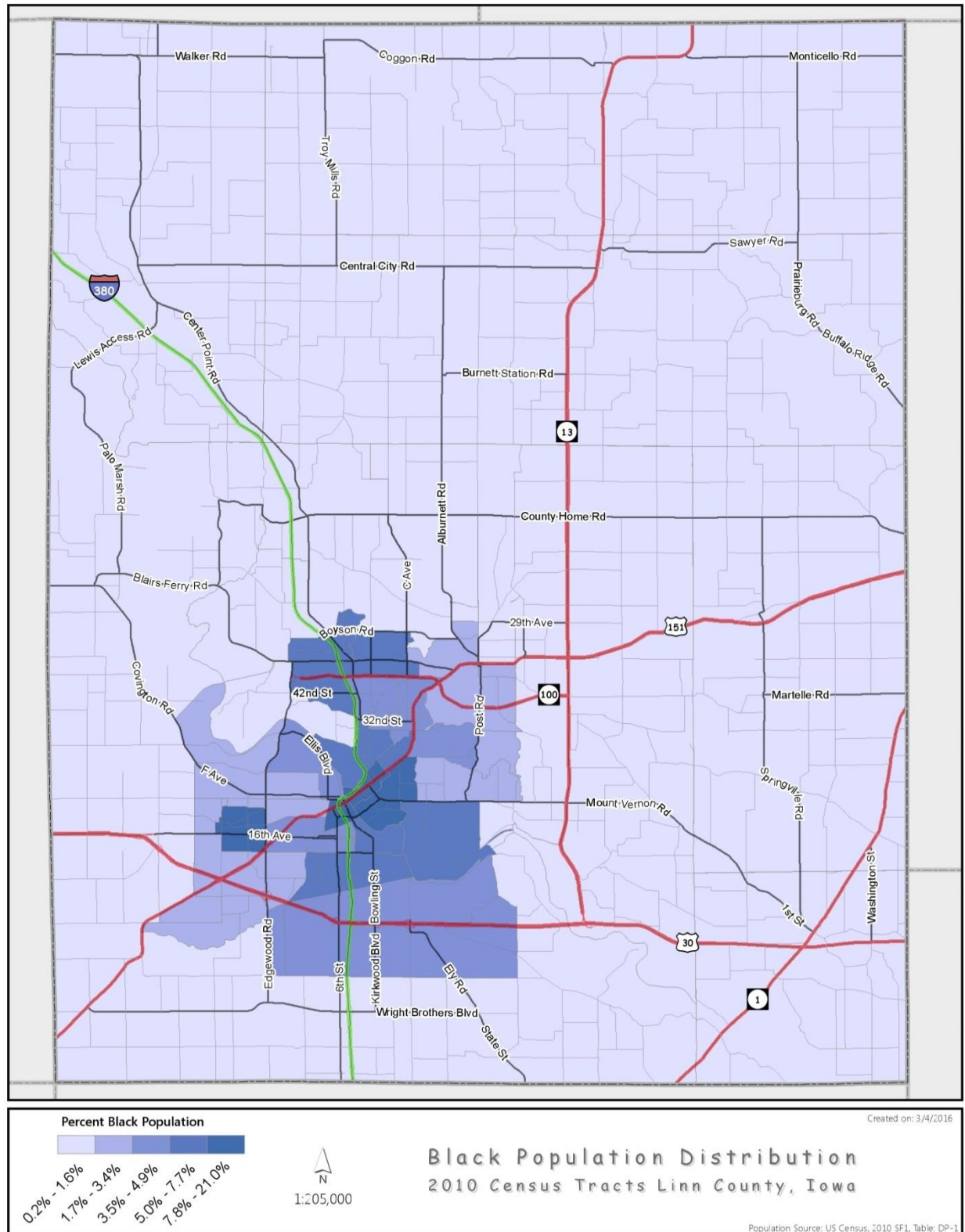
Credit: Peter Konrad, Linn County GIS

Figure 11: Population distribution of Linn County, IA, by census tract and race, 2010 census



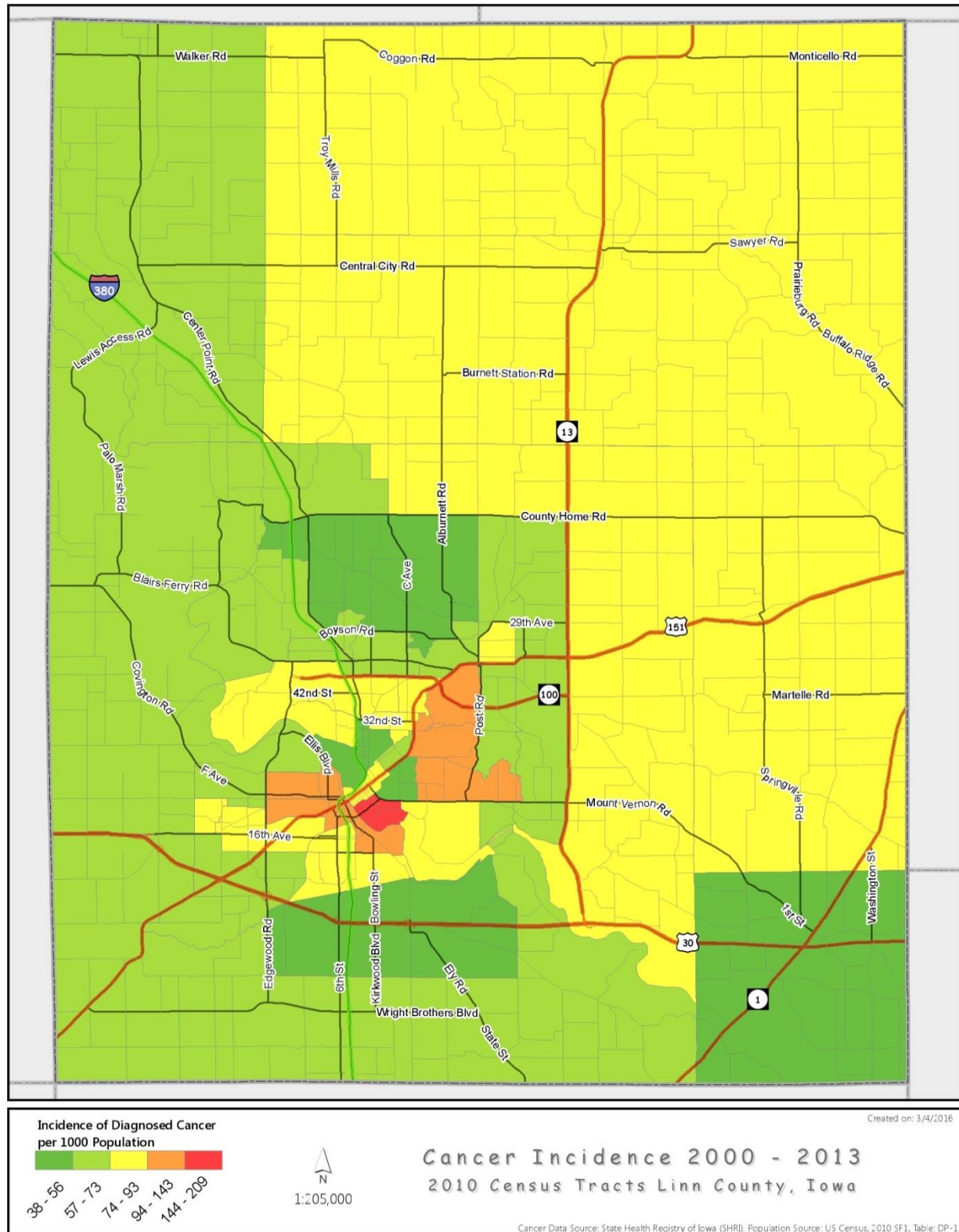
Credit: Peter Konrad, Linn County GIS

Figure 12: Population distribution of Linn County, IA, by census tract and race, 2010 census



Credit: Peter Konrad, Linn County GIS

Figure 13: All cancer incidence distribution of Linn County, IA, by census tract, 2010 census



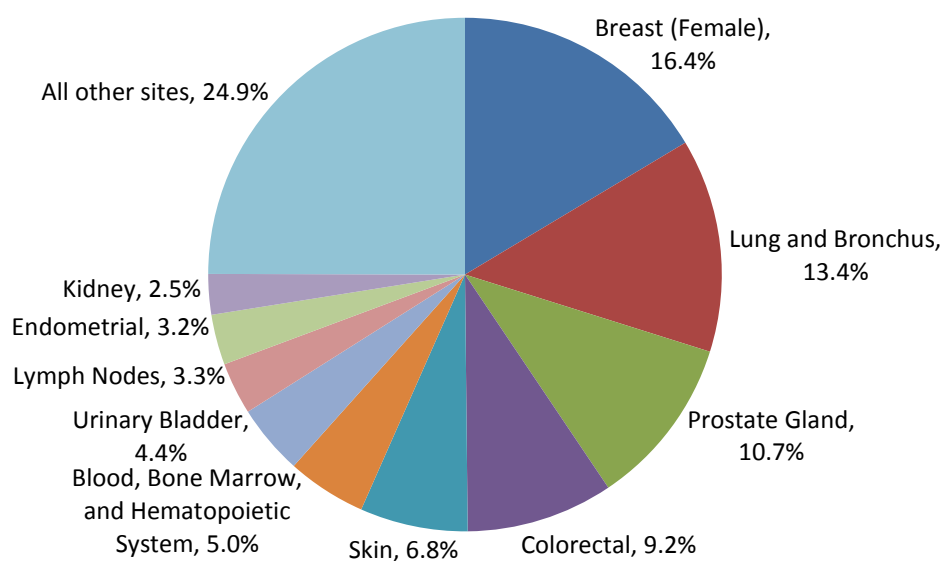
Credit: Peter Konrad, Linn County GIS

Top Ten Cancer Types

Trends

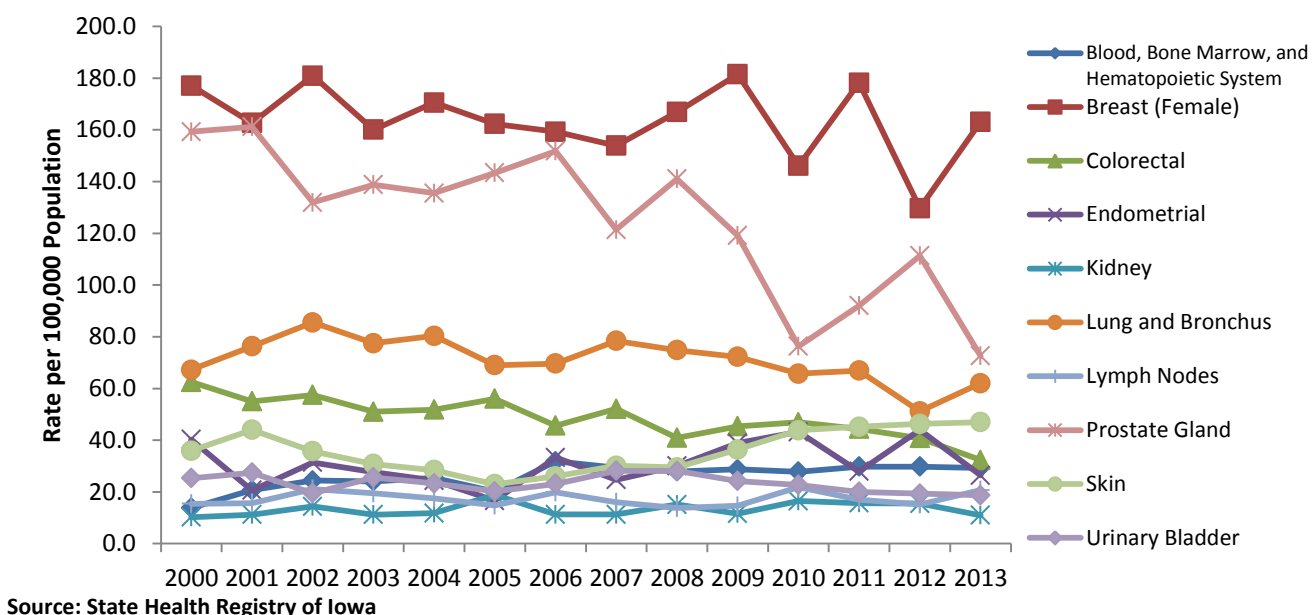
The cancer burden of Linn County can almost be completely described by ten cancer types. The top ten cancers in Linn County made up 75% of newly diagnosed cancer cases from 2000-2013 (Figure 14). Of those top ten, five cancer types accounted for approximately 57% of all newly diagnosed cases of cancer from 2000-2013 (Figure 14). Overall, the incidence rate trends over 2000-2013 for most of the top ten cancer types either decreased or stayed flat. Three of the top ten types, Blood, Bone Marrow and Hematopoietic system, Endometrial and Skin cancers, have seen an increased trend in incidence rates since 2000 (Figure 15).

Figure 14: Percent of newly diagnosed cancers, Linn County, by type, 2000-2013



Source: State Health Registry of Iowa

Figure 15: Age-adjusted incidence rates, Linn County, by type, 2000-2013



Sex

The overall cancer incidence rates from 2000-2013 in both males and females further shows the impact and burden that the top ten cancers have on the population of Linn County (Figure 16). The large impact that these cancer types have on the population is evidenced by the large incidence rates seen over the course of the past 14 years, especially among the top five cancer types. When looking at the male or female population alone some of the top ten cancer types change but consistently breast, prostate, lung and bronchus, colorectal and skin cancers all remain in the top five for either sex (Figures 17&18).

Figure 16: Age-adjusted incidence rates, Linn County, by sex and type, 2000-2013

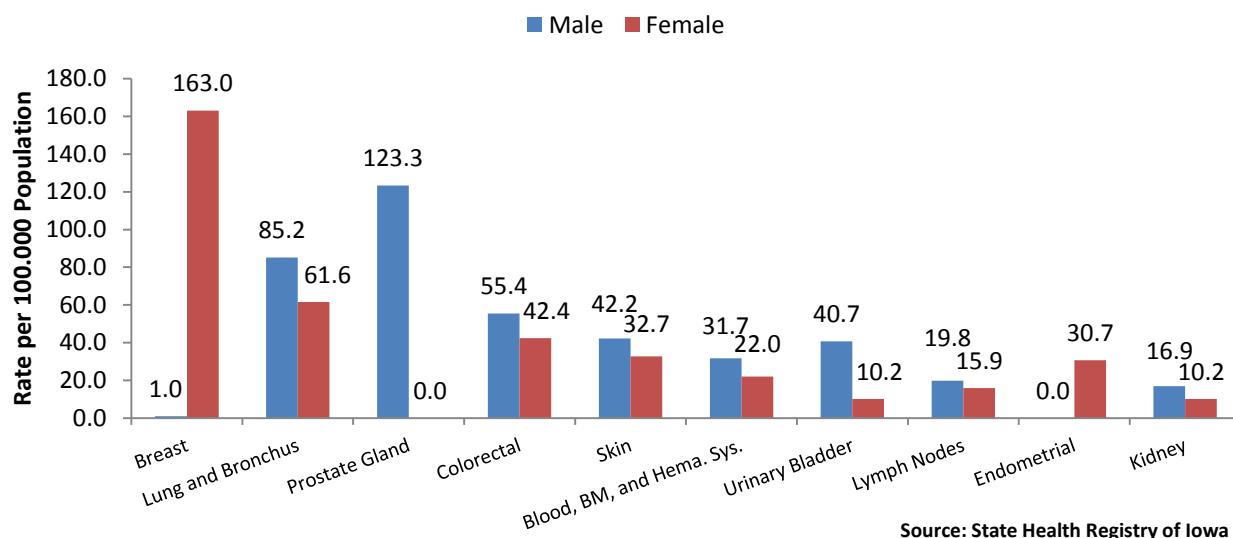
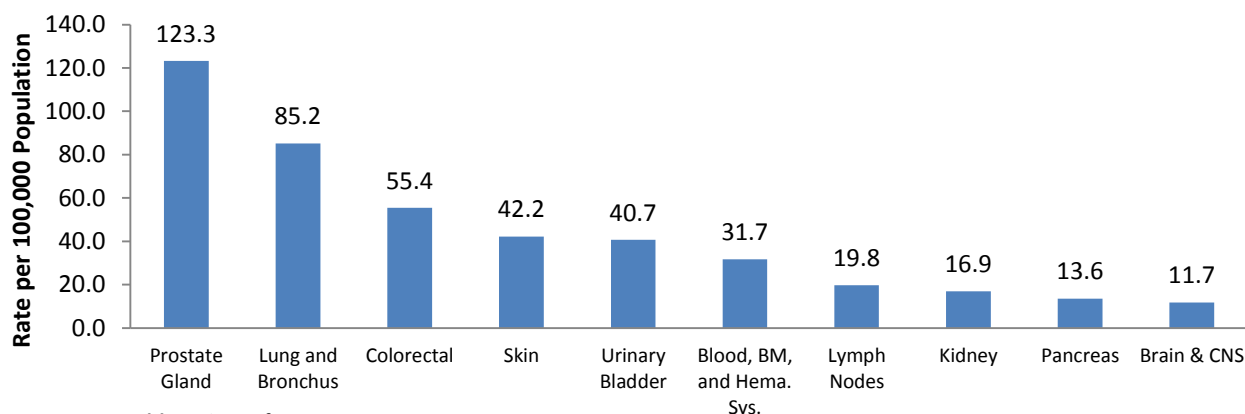


Figure 17: Age-adjusted incidence rates, Linn County, males by type, 2000-2013



Source: State Health Registry of Iowa

Figure 18: Age-adjusted incidence rates, Linn County, females by type, 2000-2013



Source: State Health Registry of Iowa

Breast and prostate cancer are the two sex-specific cancer types drastically affecting females and males respectively. In both sexes we see lung and bronchus as the second most common cancer type with colorectal and skin cancers rounding out the top four for both sexes (Figures 17&18). Interestingly two different cancer types fill in the fifth position for each sex, endometrial cancer in females and urinary bladder cancer in males (Figures 17&18). Urinary bladder and endometrial cancer come in at seventh and ninth in the overall top ten which further indicates the sex-specific differences in cancer incidence and can further direct efforts to address different cancers by sex (Figure 16).

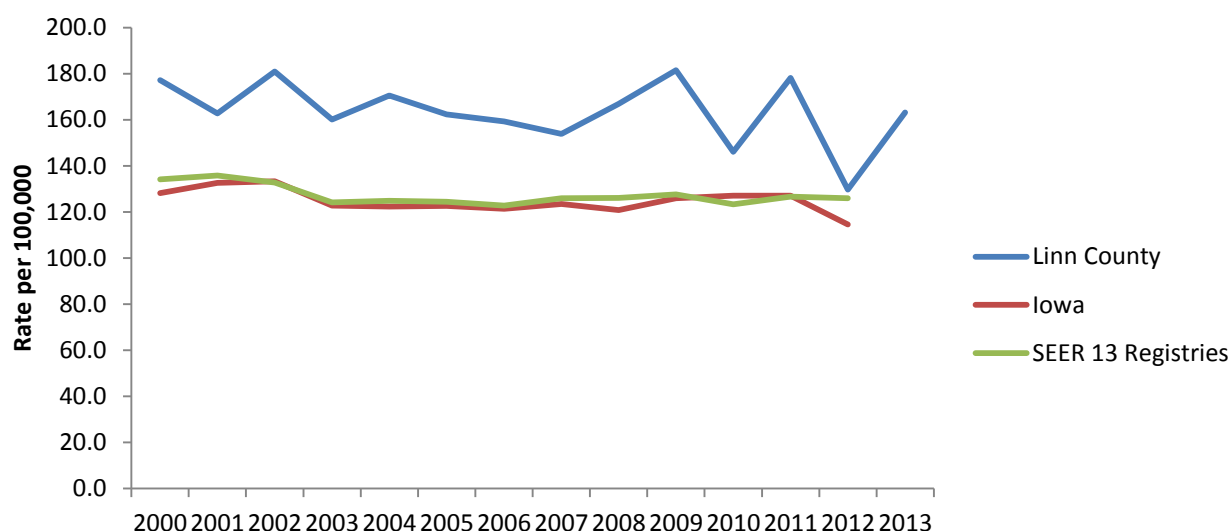
Breast Cancer

Trends

Since 2000 there has been little change in the overall trend of breast cancer incidence, with a slight decrease nationally, at the state level and in Linn County. In 2000 the incidence rate for breast cancer nationally was 134.2 per 100,000, at the state level the rate was 128.2 per 100,000 and in Linn

County the rate was 177.1 per 100,000. In 2012 those rates were down to 125.9 per 100,000 nationally, 114.5 per 100,000 at the state level, and 129.7 per 100,000 locally⁹. In Linn County alone there was an 8% decrease in breast cancer incidence since 2000. Between 2000 and 2012 there was a statistically significant 27% decrease in breast cancer incidence in Linn County. Unfortunately, in 2013 the incidence rate in Linn County jumped back up to 163.1 per 100,000, which was a 26% increase in incidence rate from 2012 (Figure 19). Between the years of 2000-2012 the incidence rate in Linn County for breast cancer has consistently been much higher than both the national and state level incidence rates, mirroring what was seen for the overall incidence rate for all cancer sites (Figure 1&19). Between the years of 2000-2013 female breast cancer alone has accounted for 16.4% of newly diagnosed cancers and is the leading cancer type in Linn County by incidence (Figure 14). Nationally, breast cancer is the most common cancer in women, regardless of race or ethnicity, the leading cause of cancer death among Hispanic women and the second leading cause of cancer death among white, black or African American, Asian or Pacific Islander and American Indian/Alaska native women¹⁰.

Figure 19: Age-adjusted incidence rates, breast (female) cancer, 2000-2013



Source: State Health Registry of Iowa, National Cancer Institute

Sex

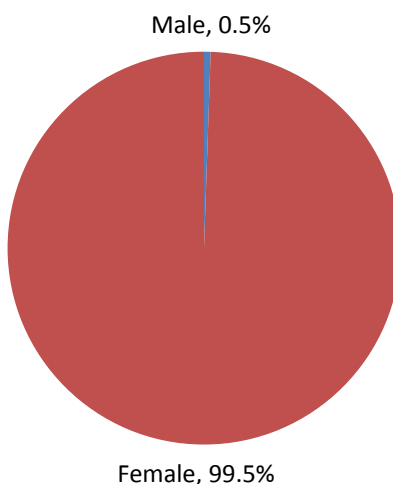
While breast cancer almost exclusively affects women it can occur in men. Between 2000-2013 the overall incidence rate of breast cancer in men was 1.0 per 100,000 as compared to the rate in women of 163.0 per 100,000 (Figure 18). Males accounted for 0.5% of newly diagnosed breast cancers between the years of 2000-2013, whereas women accounted for 99.5% (Figure 20). The disparity in

⁹ Fast Stats: An interactive tool for access to SEER cancer statistics. Female Breast Cancer. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

¹⁰ Centers for Disease Control and Prevention. Breast Cancer. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/breast/statistics/index.htm>

incidence rates and percent of new diagnoses clearly shows that while breast cancer can affect either sex, women bear almost the entire burden.

Figure 20: Percent of newly diagnosed cancer cases, Linn County, breast cancer, by sex, 2000-2013

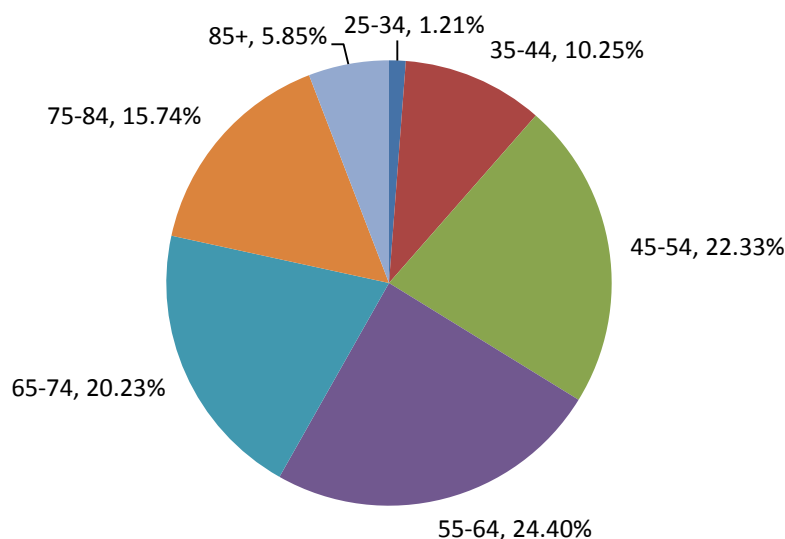


Source: State Health Registry of Iowa

Age

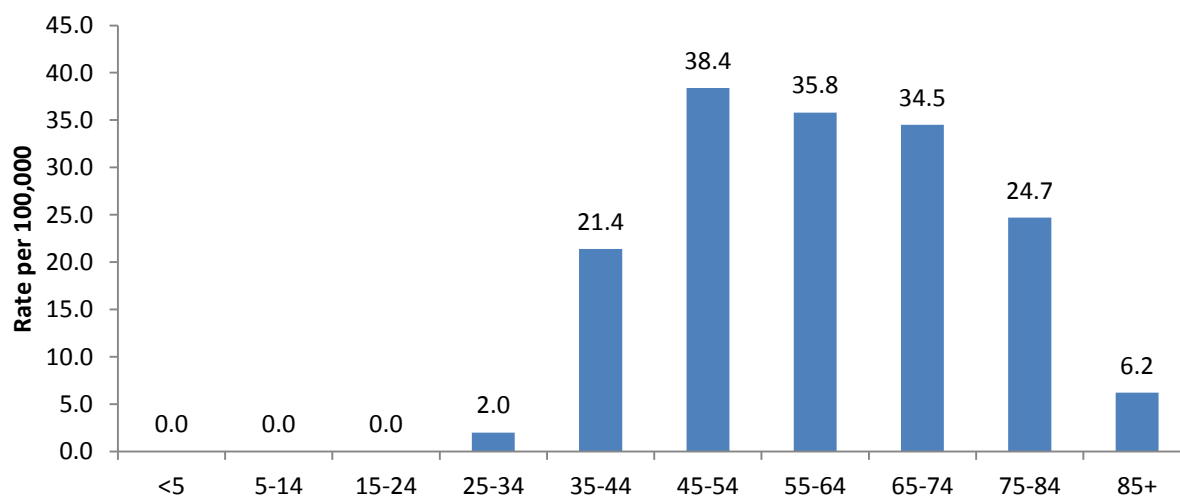
Female breast cancer can occur at any age but is most common in older women. In Linn County, no new cases of female breast cancer were diagnosed in women less than 25 years of age between the years of 2000-2013. The most common age of diagnosis in Linn County was 55-64 with 24% of all new cases between the years of 2000-2013 occurring in that age group. Women aged 45-54 and 65-74 followed closely behind with 22% and 20% of new cases respectively (Figure 21). The incidence rate of breast cancer increases with age; in Linn County female breast cancer is most commonly diagnosed in women aged 55-64, but the incidence rate is actually highest in women aged 45-54 (Figure 22). This trend follows closely with, but does not exactly mirror the overall incidence rate trend for all cancer sites by age group (Figure 5). Nationally the most common age of diagnosis for breast cancer is 61 years old⁹.

Figure 21: Percent of newly diagnosed female breast cancer, Linn County, by age, 2000-2013



Source: State Health Registry of Iowa

Figure 22: Age-adjusted incidence rates, Linn County, female breast cancer, by age group, 2000-2013

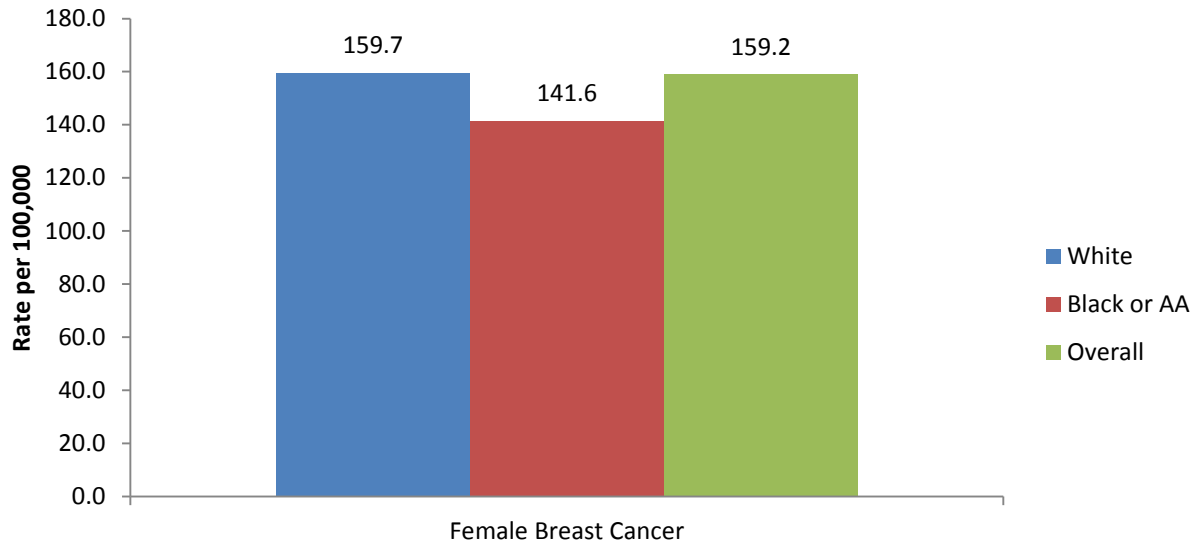


Source: State Health Registry of Iowa

Race

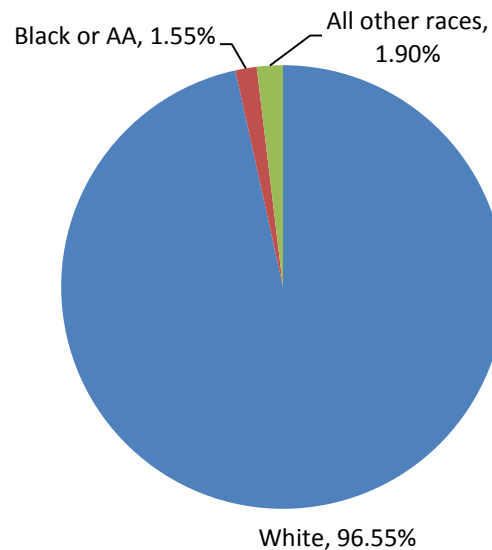
Over the years of 2009-2013 the overall incidence rate for female breast cancer was 159.2 per 100,000. In the White female population the rate was slightly higher at 159.7 per 100,000 and in the Black or African American female population the rate was lower at 141.6 per 100,000 (Figure 23). Since 2000, over 96% of newly diagnosed female breast cancers occurred in White women, versus less than 2% in Black or African American females (Figure 24).

Figure 23: Age-adjusted incidence rates, Linn County, female breast cancer, by race, 2009-2013



Source: State Health Registry of Iowa

Figure 24: Percent of newly diagnosed female breast cancer, Linn County, by race, 2000-2013

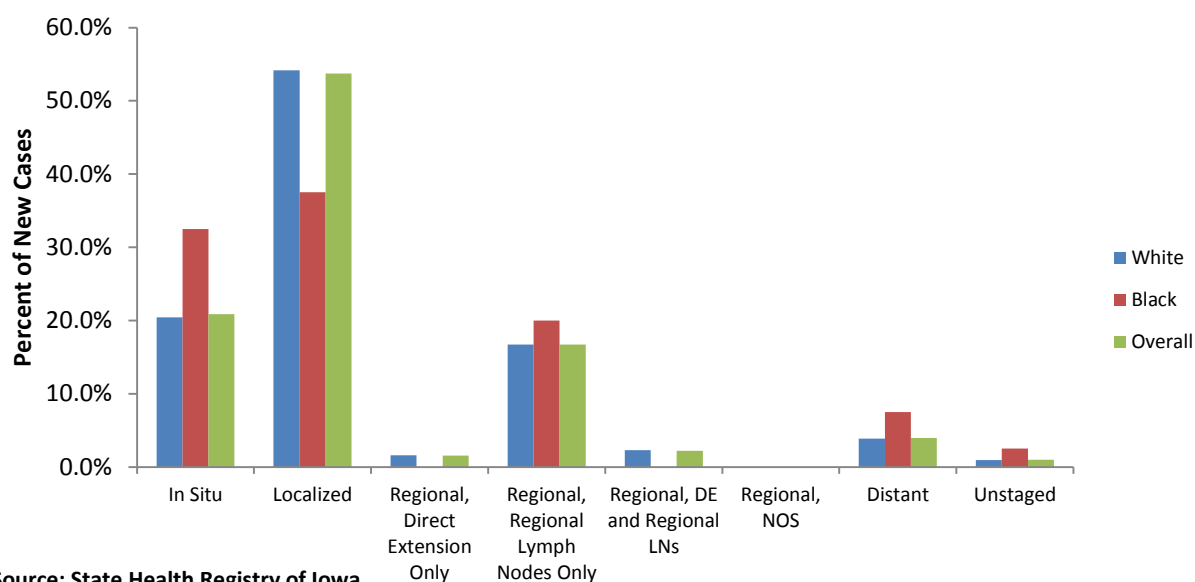


Source: State Health Registry of Iowa

Staging

Overall, over 70% of newly diagnosed female breast cancers are discovered early in the course of the disease, which may indicate a success in screening processes or programs within the county as well as an increased awareness among the population. 7.5% of newly diagnosed female breast cancers in Black or African American women are staged as “distant” as opposed to only 3.9% of newly diagnosed breast cancers in White women. While not a drastic difference, it does highlight a potential area for further investigation (Figure 25).

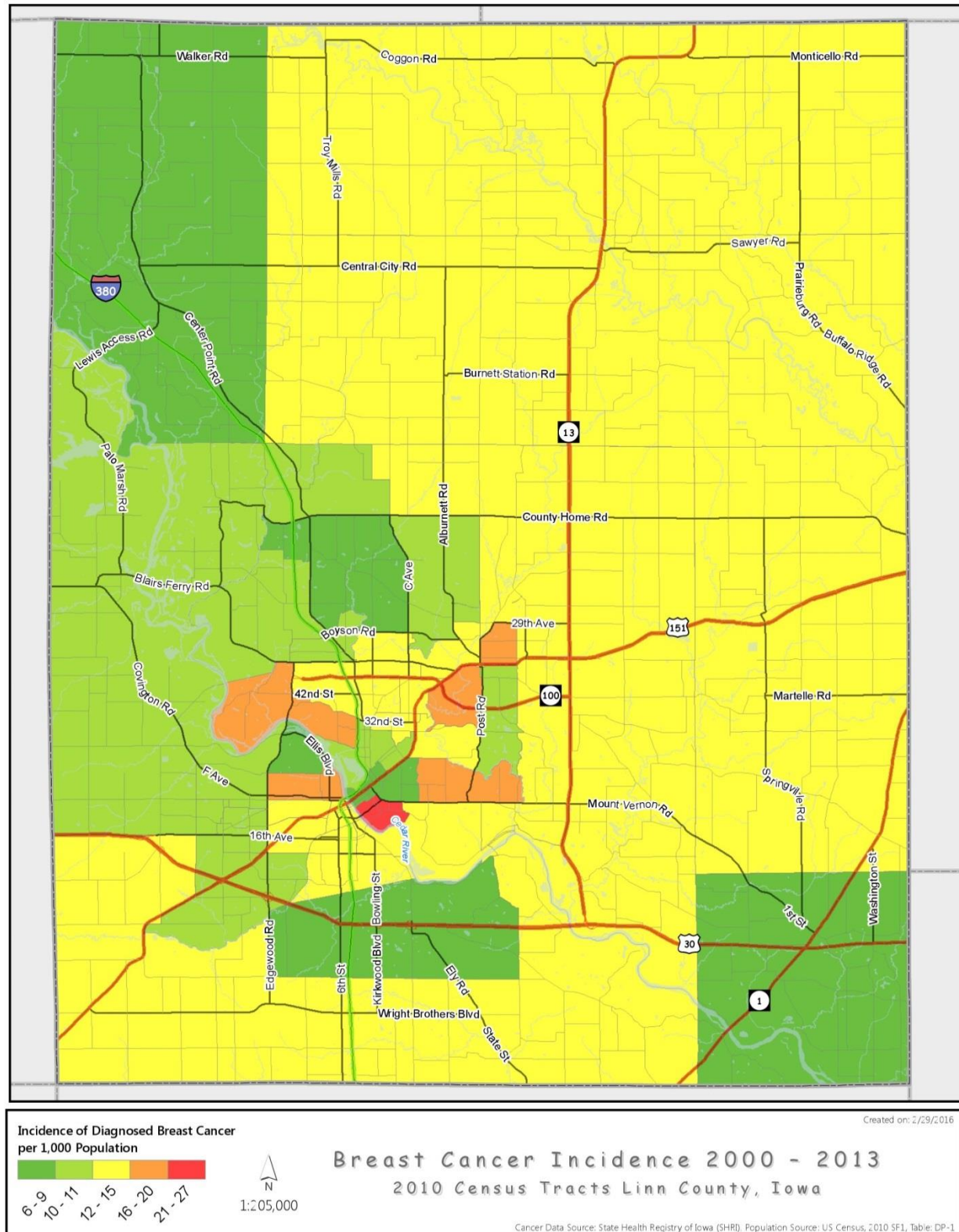
Figure 25: Female breast cancer staging, Linn County, by race, 2000-2013



Geospatial Analysis

The distribution of breast cancer incidence in Linn County is similar to the distribution seen in the map of all cancer sites (Figures 13&26). The same areas of increased incidence exist for breast cancer as for all cancer sites, with even more of the CR metro and suburban areas as well as the rural areas of Linn County showing an increased incidence rate as compared to the rest of the county. When compared to the population density maps presented earlier (Figures 10, 11, & 12) we see that the areas of increased incidence that exist for breast cancer closely follow with population density and race distribution. The more densely populated areas of Linn County are also more densely populated by Whites than by Blacks or African Americans, and with 96% of all newly diagnosed cases of female breast cancer occurring in the White population of Linn County the explanation for the moderate to moderately high incidence rates (yellow and orange areas) becomes clear. The one census tract that has a high incidence rate (red area), as compared to the rest of the census tracts, is not as densely populated as compared to the suburban parts of Cedar Rapids, but this tract also contains a large proportion of the Black or African American population of Linn County. This same trend also occurs in a majority of the more moderately high areas of the map as well; with a sizable proportion of the population in those areas being Black or African American and the population density as compared to the rest of the county being lower (Figure 26). Since the Black or African American population only makes up a small percent of overall breast cancer cases and the age-adjusted incidence rate for breast cancer is lower in this population, the increased incidence in these areas cannot be solely explained by a difference in race. These areas of the Cedar Rapids metro area could contain an increased older population, which is disproportionately affected by breast cancer and could explain the higher rate of breast cancer incidence.

Figure 26: Breast cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census



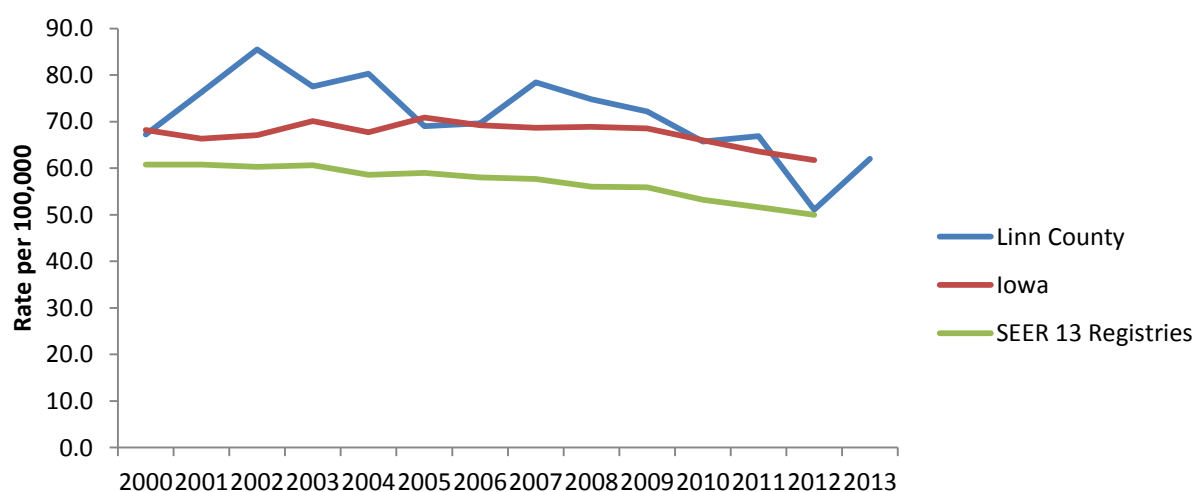
Credit: Peter Konrad, Linn County GIS

Lung and Bronchus Cancer

Trends

Since 2000, lung and bronchus cancer incidence has been slowly decreasing nationally and in Iowa as a whole. In Linn County the trend has varied widely from year to year, but overall there has been a slight decrease in lung cancer incidence. Since 2000 there has been an 8% decrease in lung cancer incidence, with a statistically significant decrease of 27% between 2002 and 2013. In 2000 the age-adjusted incidence rate in Linn County was 67.2 per 100,000, in Iowa as a whole the rate was 68.2 per 100,000, and nationally the rate was 60.8 per 100,000. Similar to what was seen with all cancer sites and breast cancer, Linn County has consistently higher incidence rates as compared to both the state and the nation. The age-adjusted incidence rate in Linn County for lung cancer got as high as 85.5 per 100,000 in 2002 and as low as 51.1 per 100,000 in 2012 (Figure 27). Lung and bronchus cancer accounts for 13.4% of all newly diagnosed cancers in Linn County and lung and bronchus cancer is the second most common cancer type by incidence behind breast cancer (Figure 14). This trend mirrors the national trend as well. Lung cancer is the second most common cancer nationally and the leading cause of cancer deaths. In 2011, lung cancer accounted for 14% of all cancer diagnoses and 27% of all cancer deaths. Cigarette smoking is the leading cause of lung cancer. Radon exposure is the second leading cause of lung cancer in smokers and the leading cause of lung cancer in non-smokers^{11,12}.

Figure 27: Age-adjusted incidence rates, lung and bronchus cancer, 2000-2013



Source: State Health Registry of Iowa, National Cancer Institute

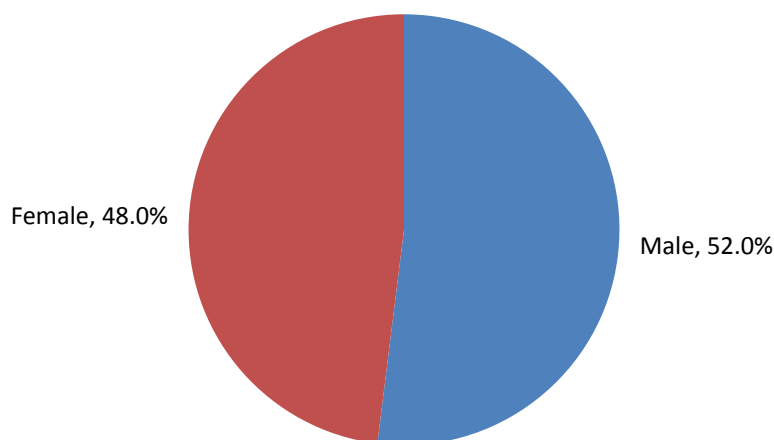
¹¹ Centers for Disease Control and Prevention. Lung Cancer. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/lung/index.htm>

¹² Iowa Department of Public Health. Radon. (2016, March 09). Retrieved March 14, 2016, from <http://www.idph.iowa.gov/radon>

Sex

In both men and women, lung cancer is the second most common cancer type and the leading cause of cancer deaths¹¹. In Linn County, this trend is also true (Figures 17&18). Men are slightly more at risk for developing lung cancer than women in Linn County, with the overall age-adjusted rate of 85.2 per 100,000 in men as opposed to 61.6 per 100,000 for women (Figure 16). 52% of newly diagnosed lung cancers between the years of 2000-2013 were diagnosed in men (Figure 28). While men are slightly more affected than women, the distribution is nearly 50/50 and lung cancer is still the second most common type of cancer overall and the second most common type of cancer in each sex (Figure 14, 17&18).

Figure 28: Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by sex, 2000-2013



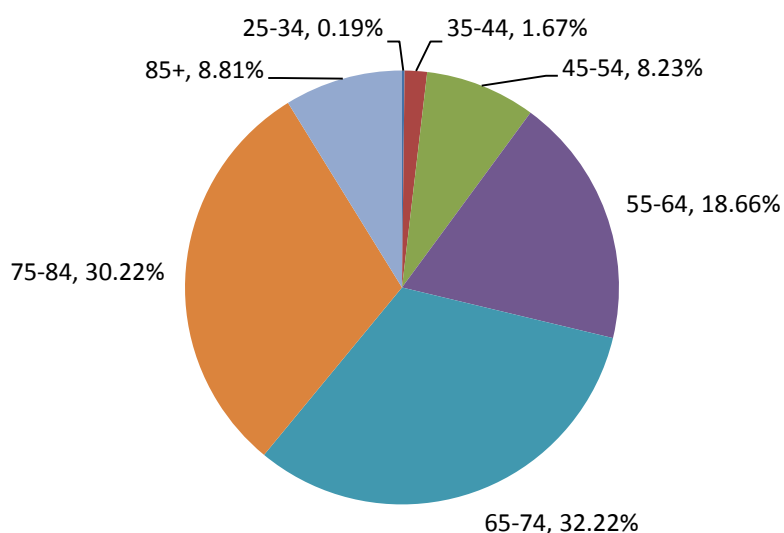
Source: State Health Registry of Iowa

Age

Lung cancer is a cancer that most commonly affects the older population, with over 60% of newly diagnosed cases in Linn County occurring between the ages of 65-84 and just over 10% of new cases occurring in people aged 54 and younger (Figure 29). The age-adjusted incidence rates mirror this trend with the incidence rate peaking between the age groups 65-74 and 75-84 (Figure 30). Nationally, this trend is similar with the most common age of diagnosis of lung cancer being age 70¹³.

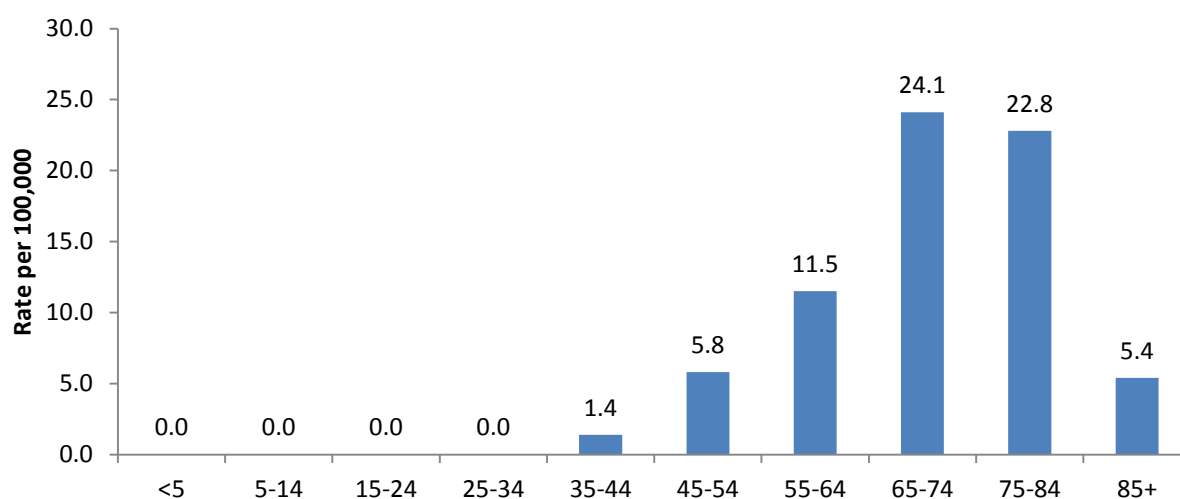
¹³ Fast Stats: An interactive tool for access to SEER cancer statistics. Lung and Bronchus Cancer. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

Figure 29: Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

Figure 30: Age-adjusted incidence rates, Linn County, lung and bronchus cancer, by age group, 2000-2013

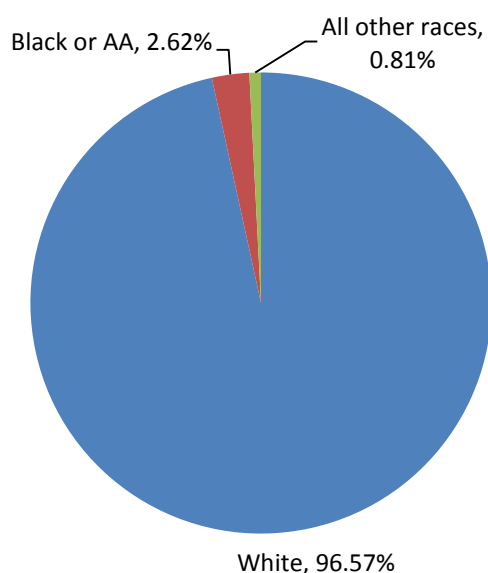


Source: State Health Registry of Iowa

Race

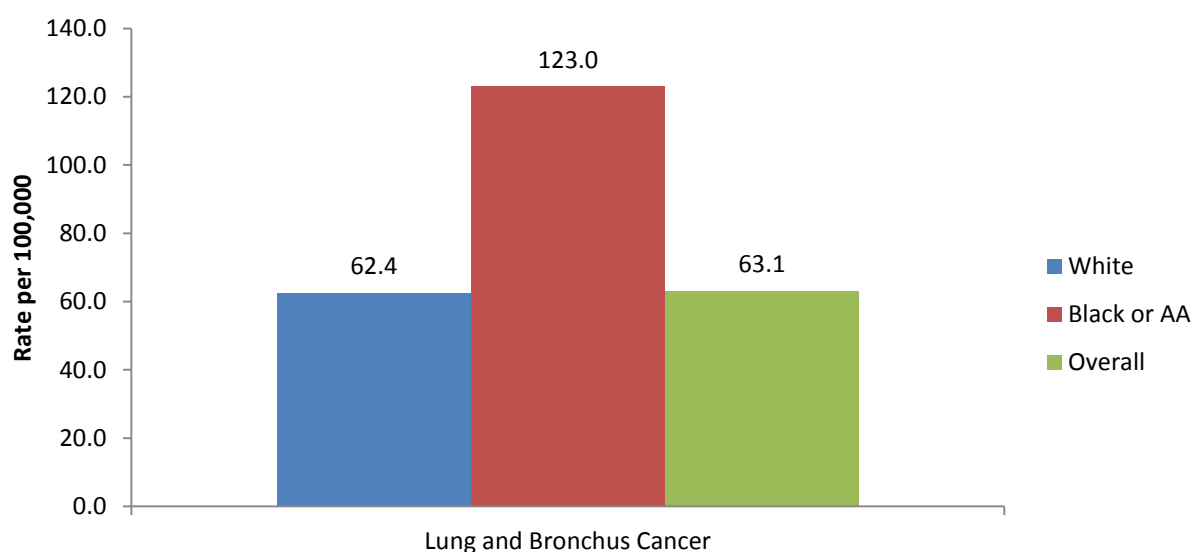
96% of all newly diagnosed lung cancers in Linn County occur in the White population with only 2.6% occurring in the Black or African American population (Figure 31). While the majority of newly diagnosed cases occur in Whites, the age-adjusted incidence rates show that the Black or African American population is disproportionately affected by lung cancer. The age-adjusted incidence rate in the Black or African American population of Linn County is almost double that of the White population at 123.0 per 100,000 compared to 62.4 per 100,000 (Figure 32).

Figure 31: Percent of newly diagnosed cancer cases, Linn County, lung and bronchus cancer, by race, 2000-2013



Source: State Health Registry of Iowa

Figure 32: Age-adjusted incidence rates, Linn County, lung and bronchus cancer, by race, 2009-2013

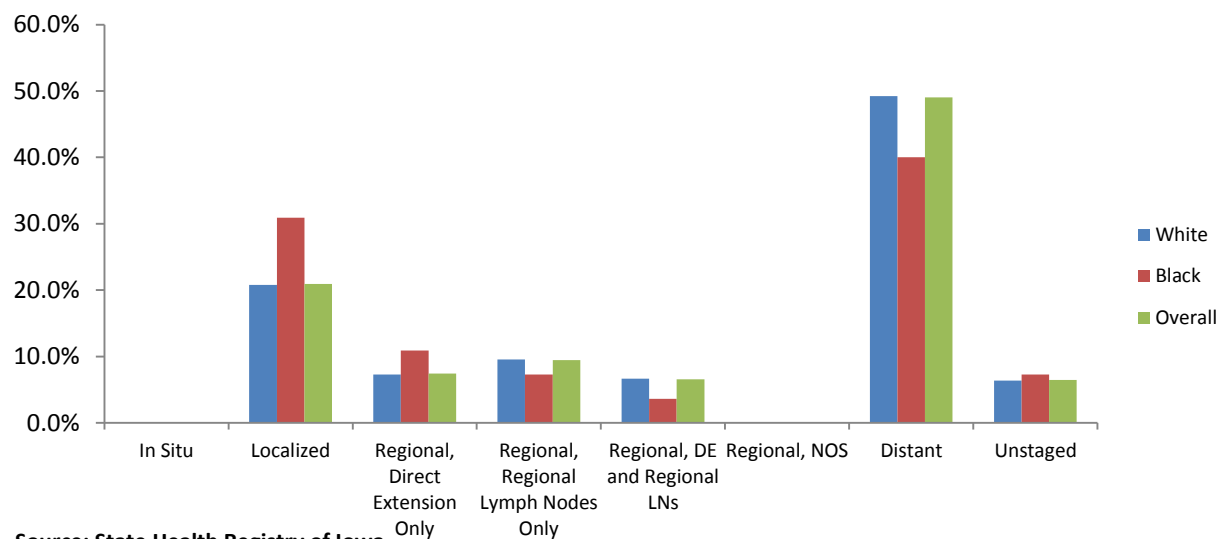


Source: State Health Registry of Iowa

Staging

Overall, nearly 50% of all newly diagnosed lung cancers are staged as “distant”. This trend holds true for the White population of Linn County, but for the Black and African American population the rate is slightly lower at around 40% of all new cases staged as “distant” (Figure 33). This overall trend is the opposite of what was seen for all cancer sites (Figure 6). This indicates a potential area for improvement or intervention in screening and awareness.

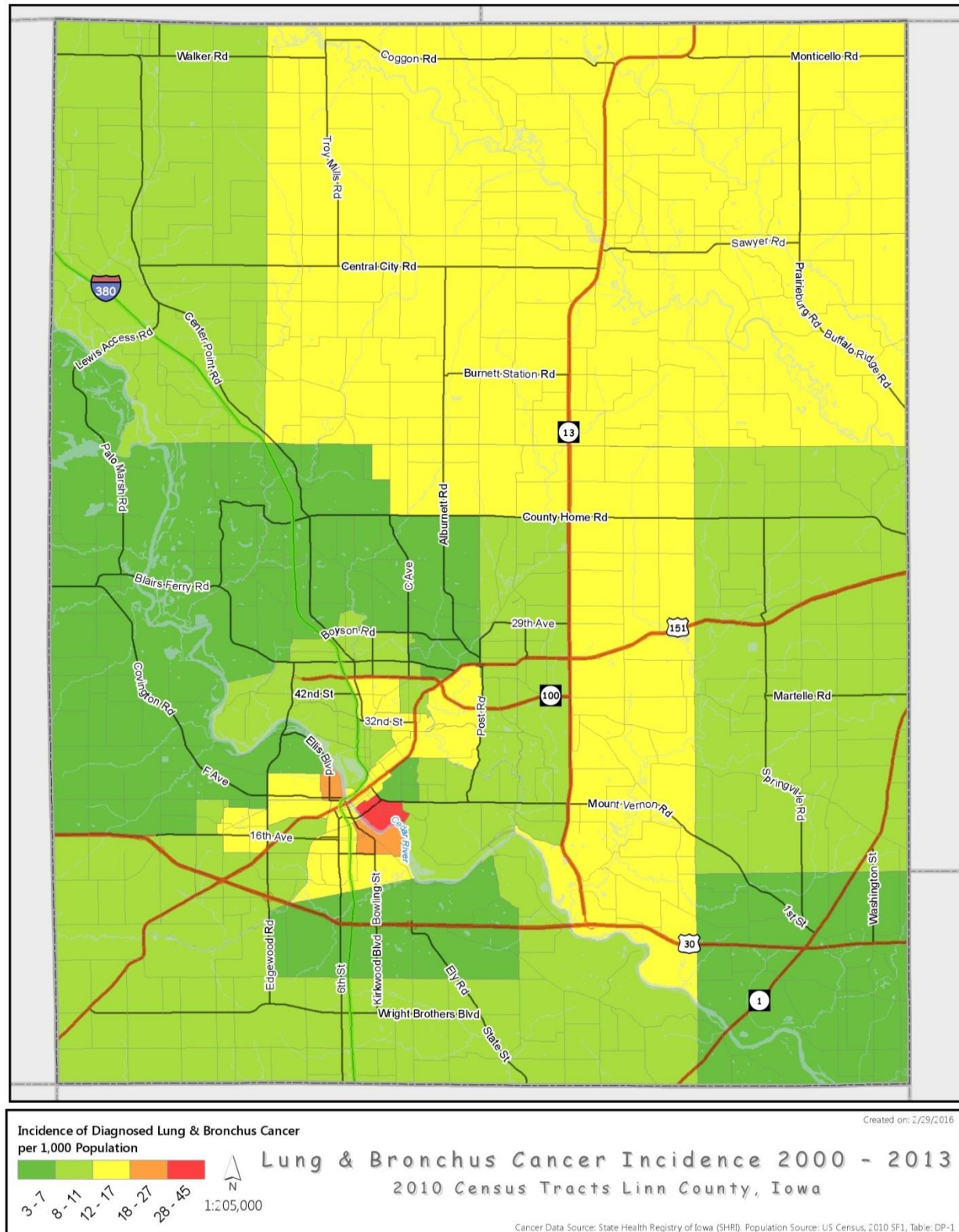
Figure 33: Lung and bronchus cancer staging, Linn County, by race, 2000-2013



Geospatial Analysis

Similar to both of the breast cancer and all site cancer incidence maps, the lung and bronchus cancer incidence distribution across Linn County mirrors some of the areas of increased incidence seen before. The same northeastern rural and metro areas of Cedar Rapids show up on the lung and bronchus cancer incidence map with higher incidence rates, which could be indicative of older populations especially in the predominantly White rural areas. The same area that had high incidence (red area) in both the breast and all sites cancer maps again is in the high incidence bracket on the lung and bronchus map, which further exemplifies the large disparity seen in the age-adjusted rates between the White and Black and African American populations of Linn County as well as the burden of cancer on the Black and African American population (Figure 12&34). The areas of higher incidence in the metro areas of Cedar Rapids contain a significant proportion of the Black and African American population of Linn County, indicating the need for targeted action in these communities and suggesting further study as to the demographics of those areas and how that may be playing a role in the observed rate of cancer incidence in these areas.

Figure 34: Lung and bronchus cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census



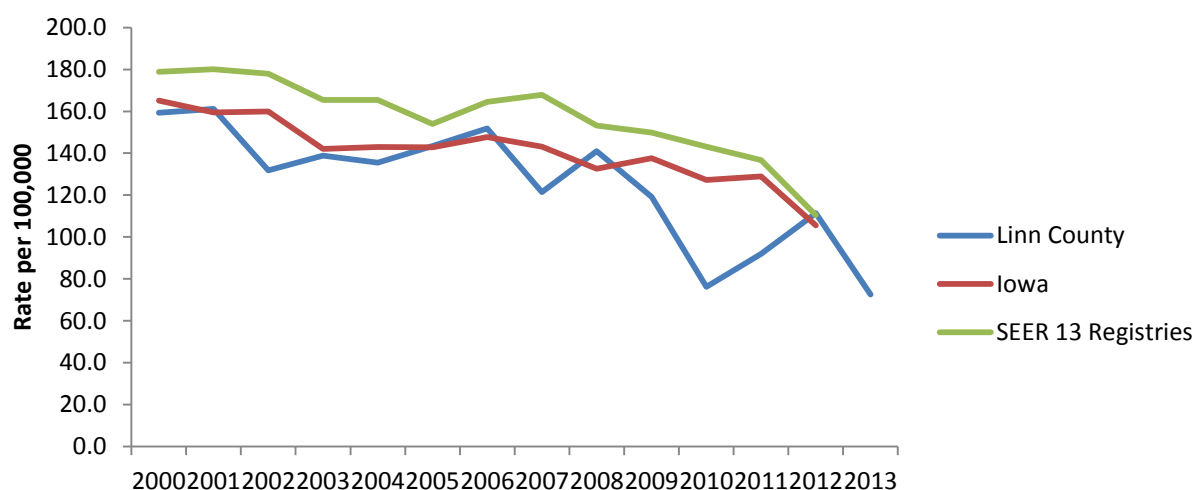
Credit: Peter Konrad, Linn County GIS

Prostate Cancer

Trends

Since 2000 prostate cancer has been drastically declining not only in Linn County, but at the state and national levels as well. In 2000, the age-adjusted incidence rate of prostate cancer in Linn County was 159.3 per 100,000 compared to 178.9 per 100,000 nationally and 165.1 per 100,000 at the state level. In 2012 those rates were down to 111.3 per 100,000 for Linn County, 110.4 per 100,000 nationally and 105.5 per 100,000 for Iowa as a whole. The decreasing trend continued into 2013 for Linn County with the rate dropping to 72.6 per 100,000, the lowest it has been in the past 14 years (Figure 35). This trend translates to a statistically significant 54% decrease in prostate cancer incidence between 2000 and 2013. Prostate cancer accounted for 10% of all new cancers diagnosed in Linn County since 2000 (Figure 14) and is the leading cause of cancer in men (Figure 17). Nationally, aside from skin cancer, prostate cancer is the leading cause of cancer in men and the second leading cause of cancer death in White, Black and African American, American Indian/Alaskan Native and Hispanic men and the fourth leading cause of cancer death in Asian or Pacific Islander men. Many men with prostate cancer, especially for men whose tumors have not spread past the prostate gland itself, die from other causes without experiencing symptoms of their prostate cancer¹⁴.

Figure 35: Age-adjusted incidence rates, prostate cancer, 2000-2013



Source: State Health Registry of Iowa, National Cancer Institute

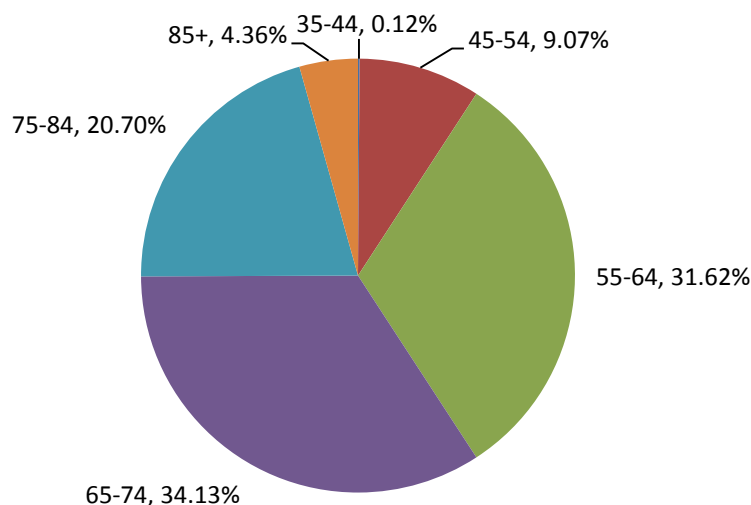
Age

Prostate cancer is mainly a cancer of the older population with over 80% of all newly diagnosed prostate cancers occurring between the ages of 55-84 and less than 1% occurring in those younger than 45 (Figure 36). Nationally, the average age of diagnosis for prostate cancer is 66 years old, which is

¹⁴ Centers for Disease Control and Prevention. Prostate Cancer. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/prostate/statistics/index.htm>

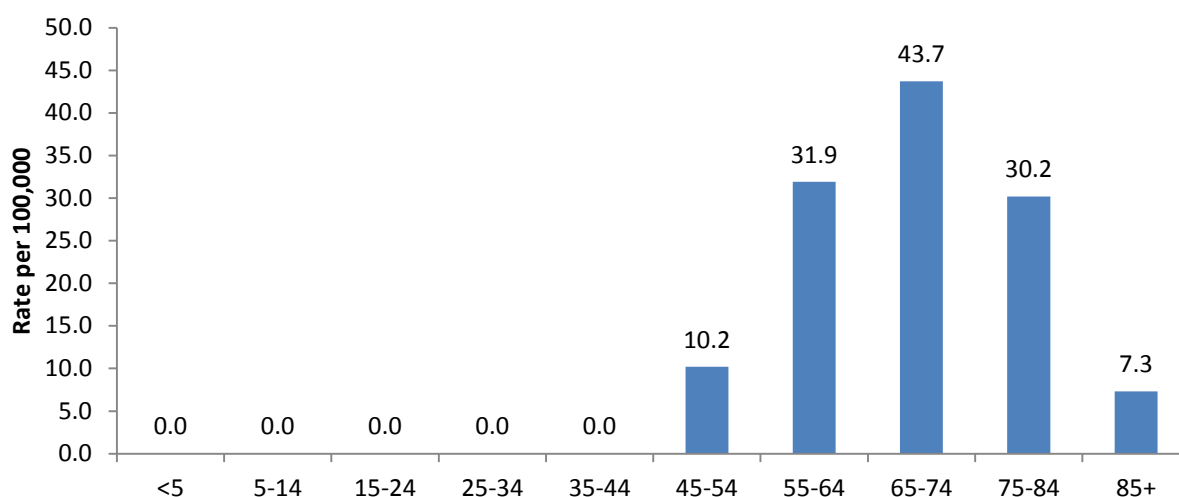
mirrored by the incidence rates, seen by age group with the highest age-adjusted incidence rate occurring in the 65-74 age group in Linn County¹⁵(Figure 37).

Figure 36: Percent of newly diagnosed cancer cases, Linn County, prostate cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

Figure 37: Age-adjusted incidence rates, Linn County, prostate cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

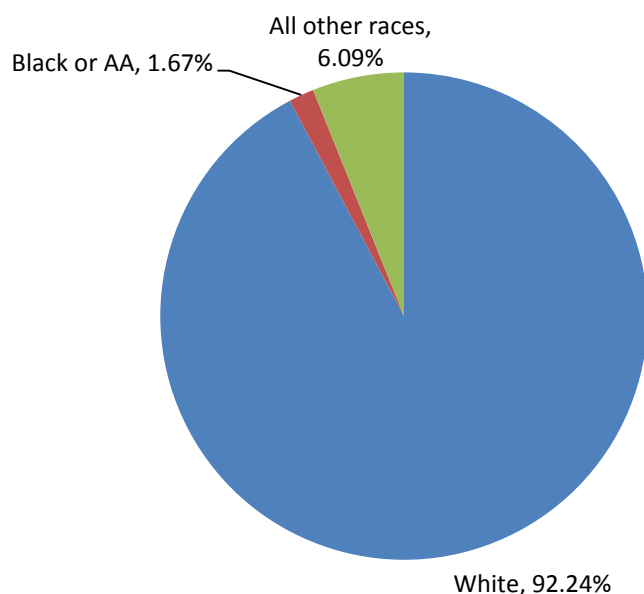
Race

Since 2000 in Linn County, 92% of all newly diagnosed prostate cancers occurred in White men, with only 1.6% occurring in Black and African American men and 6% in all other races combined (Figure 38). Even though Black or African American men only accounted for 1.6% of all newly diagnosed

¹⁵ Fast Stats: An interactive tool for access to SEER cancer statistics. Prostate Cancer. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

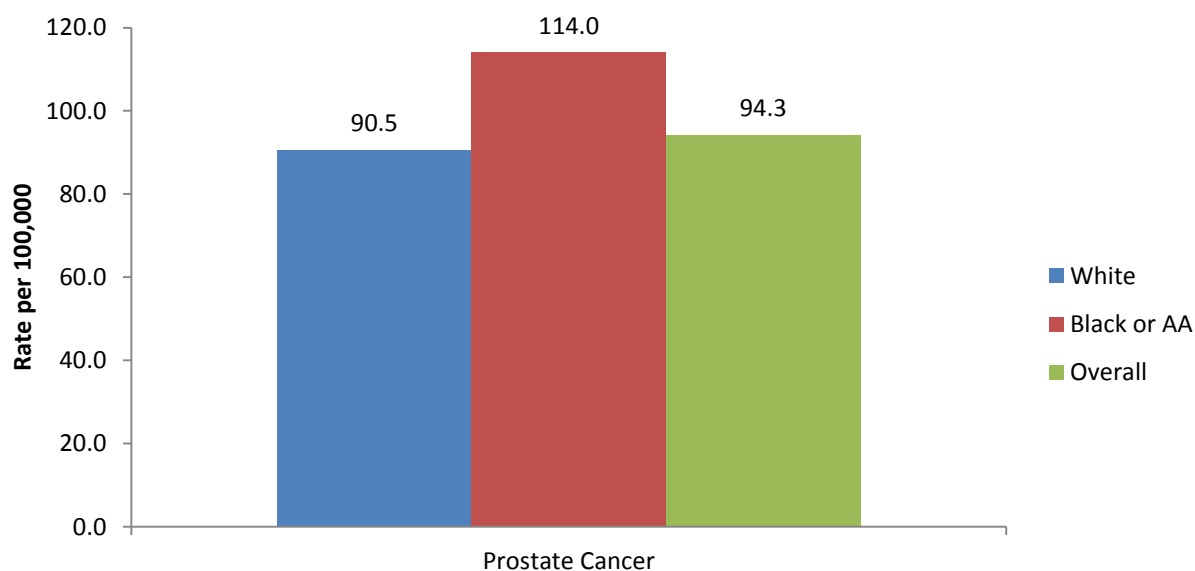
prostate cancer cases, the age-adjusted incidence rate in that population was 114.0 per 100,000 as compared to 90.5 per 100,000 for White men, which is lower than the overall age-adjusted incidence rate of 94.3 per 100,000 (Figure 39).

Figure 38: Percent of newly diagnosed cancer cases, Linn County, prostate cancer, by race, 2000-2013



Source: State Health Registry of Iowa

Figure 39: Age-adjusted incidence rates, Linn County, prostate cancer, by race, 2009-2013

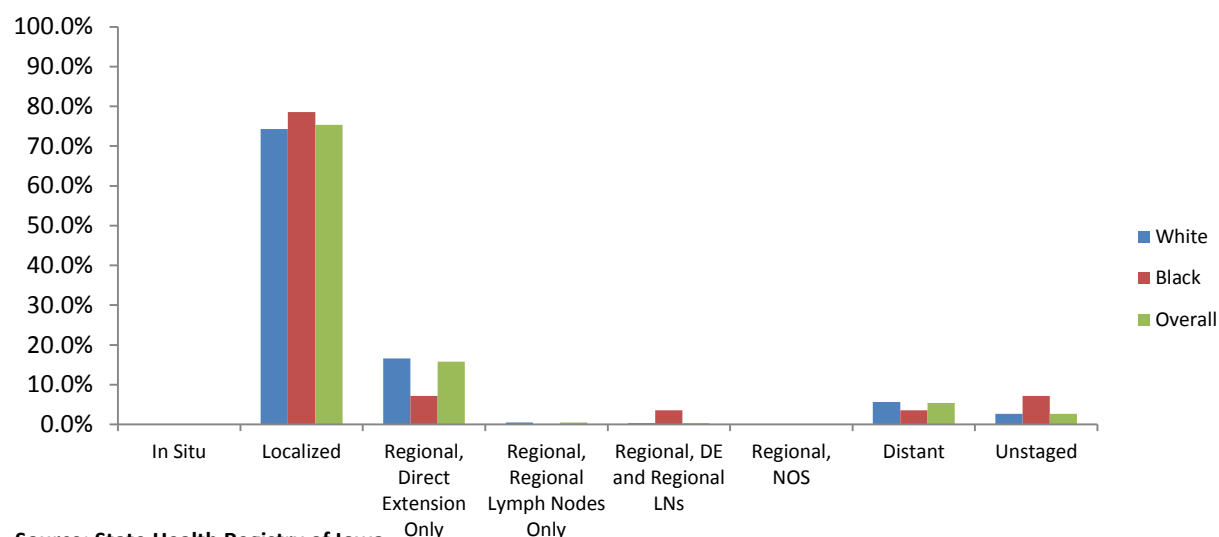


Source: State Health Registry of Iowa

Staging

The vast majority of newly diagnosed prostate cancers are staged as “localized”, with over 70% of all newly diagnosed cases of prostate cancer staged as such. 7% of prostate cancers in Black or African American men were not staged as compared to only 2.7% of prostate cancers in White men, indicating a potential gap in screening coverage (Figure 40).

Figure 40: Prostate cancer staging, Linn County, by race, 2000-2013

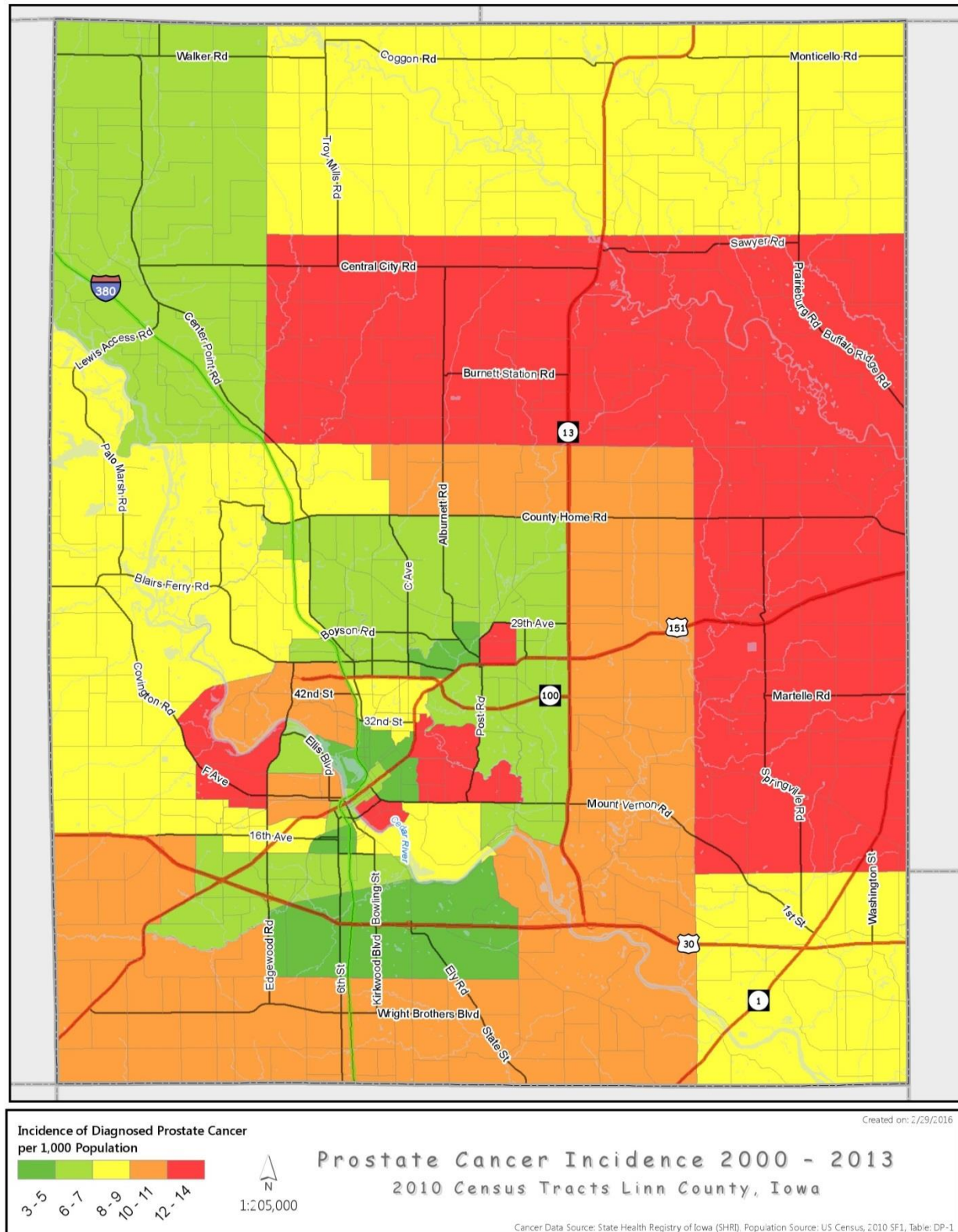


Source: State Health Registry of Iowa

Geospatial Analysis

The map of prostate cancer incidence distribution in Linn County is similar to what has been seen before for the previous cancer types, but the wide range of high incidence rates is strikingly different. This wider range of high incidence could be indicative of the large burden of prostate cancer in the male population of Linn County, or could indicate a large older population in each census tract, due to the disproportionate rate of prostate cancer in the older population. While a larger area of Linn County appears to be affected by high incidence rates of prostate cancer, the same area of high incidence in the Cedar Rapids metro area is again in the high incidence bracket. Again this can possibly be explained by the larger proportion of Black or African Americans in this census tract, as well as the higher incidence rate in the male Black or African American population (Figure 41).

Figure 41: Prostate cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census



Credit: Peter Konrad, Linn County GIS

Colorectal Cancer

Trends

Colorectal cancer incidence has been on the decline nationally, at the state level and in Linn County since 2000. In 2000 the age-adjusted incidence rate for colorectal cancer was at its highest point in the last 14 years for the nation, Iowa and Linn County at 53.3 per 100,000, 62.2 per 100,000 and 62.5 per 100,000 respectively. In 2012 those rates were down to 38.0 per 100,000 nationally, 44.2 per 100,000 at the state level and 40.8 per 100,000 in Linn County. In 2013, the age-adjusted incidence rate for colorectal cancer reached its lowest point for Linn County at 32.3 per 100,000 (Figure 42). Between 2000 and 2013 there was a statistically significant 48% decrease in colorectal cancer incidence in Linn County. Regardless of sex colorectal cancer is the third most common cancer nationally and of cancers that affect both sexes it is the second leading cause of cancer deaths¹⁶.

Figure 42: Age-adjusted incidence rates, colorectal cancer, 2000-2013



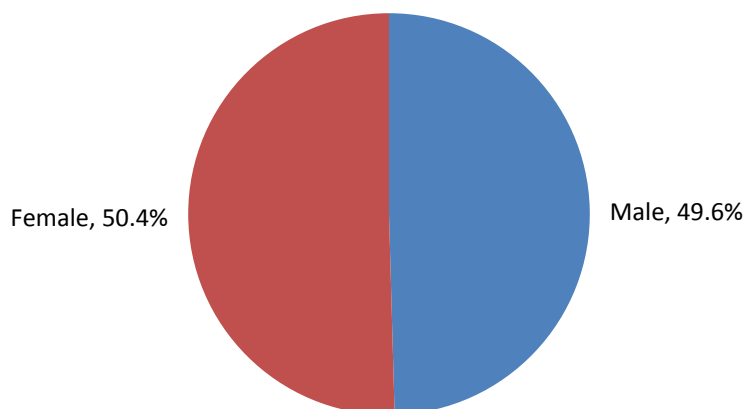
Source: State Health Registry of Iowa, National Cancer Institute

Sex

Colorectal cancer affects men and women almost equally in Linn County with 49.6% of newly diagnosed colorectal cancer cases since 2000 occurring in men and 50.4% occurring in women (Figure 43). Colorectal cancer is the fourth most common cancer in Linn County for both sexes combined, and is the third leading cause of cancer in both men and women when accounting for each sex separately (Figures 16-18).

¹⁶ Centers for Disease Control and Prevention. Colorectal (Colon) Cancer. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/colorectal/statistics/index.htm>

Figure 43: Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by sex, 2000-2013

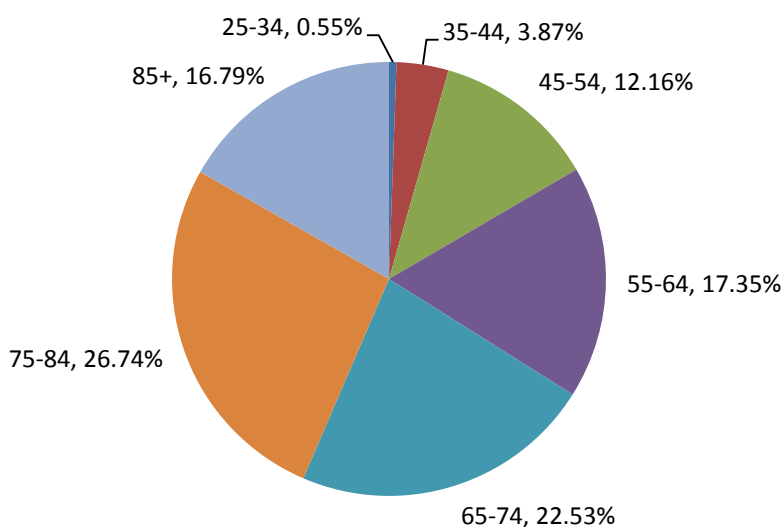


Source: State Health Registry of Iowa

Age

Similar to the other cancer types discussed earlier, colorectal cancer is mainly a cancer of the older population with only approximately 4.5% of all newly diagnosed colorectal cancers occurring in those aged 44 or younger (Figure 44). The incidence rate of colorectal cancer also increases by age peaking in the age group of 75-84, further indicating the impact that this cancer has on the older population (Figure 45). Nationally, the average age of diagnosis for colorectal cancer is 68 years old¹⁷.

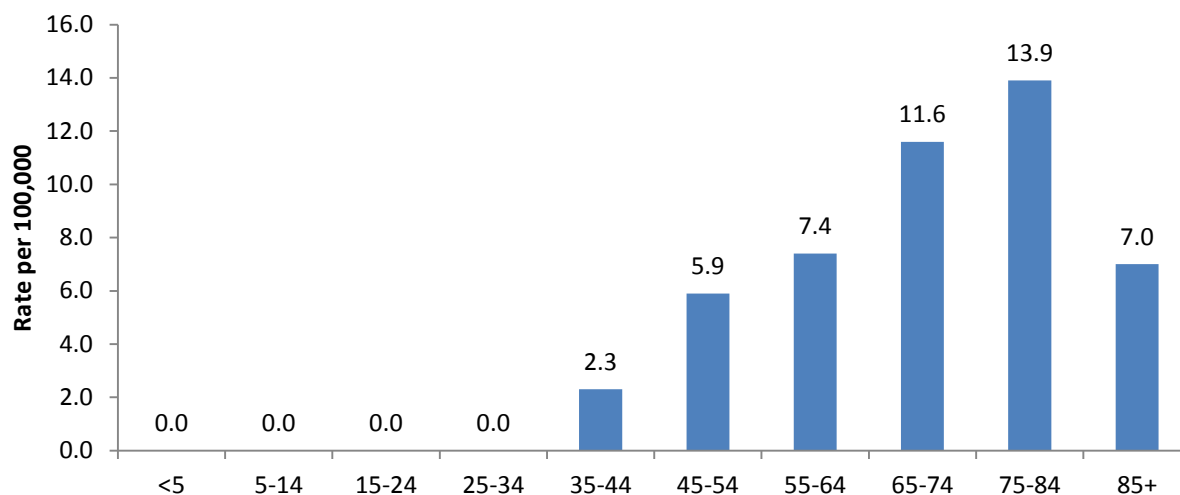
Figure 44: Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

¹⁷ Fast Stats: An interactive tool for access to SEER cancer statistics. Colon and Rectum Cancer. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

Figure 45: Age-adjusted incidence rates, Linn County, colorectal cancer, by age group, 2000-2013

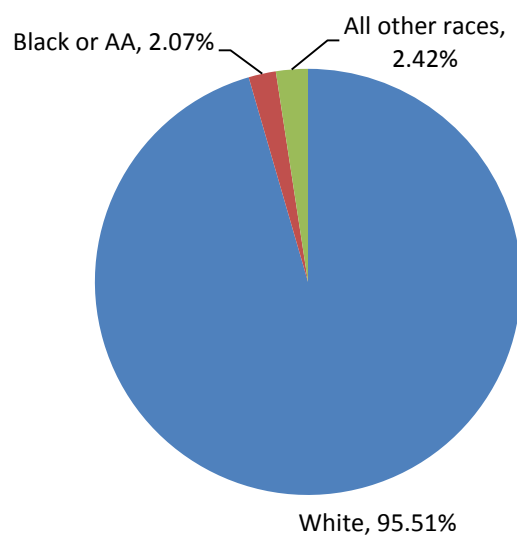


Source: State Health Registry of Iowa

Race

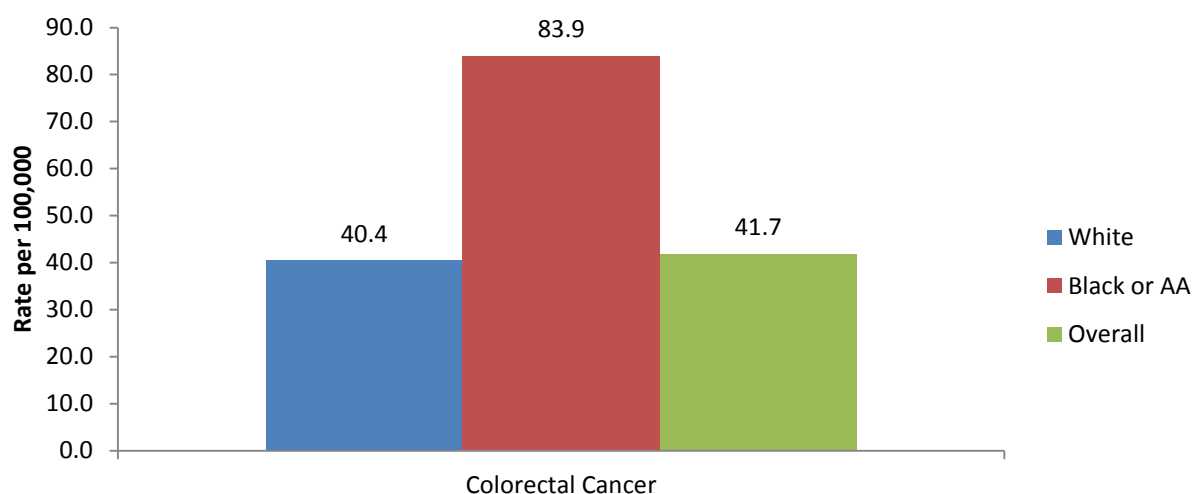
Since 2000, 95% of all newly diagnosed colorectal cancer cases occurred in the White population, 2% occurred in the Black or African American population and 2% in all other races combined (Figure 46). Similar to what has been shown in other cancer types the age-adjusted incidence rate for colorectal cancer in the Black or African American population is higher than the White population. The age-adjusted incidence rate of colorectal cancer in the Black or African American population of Linn County is more than double that for both the White population and the overall age-adjusted incidence rate at 83.9 per 100,000 (Figure 47).

Figure 46: Percent of newly diagnosed cancer cases, Linn County, colorectal cancer, by race, 2000-2013



Source: State Health Registry of Iowa

Figure 47: Age-adjusted incidence rates, Linn County, colorectal cancer, by race, 2009-2013

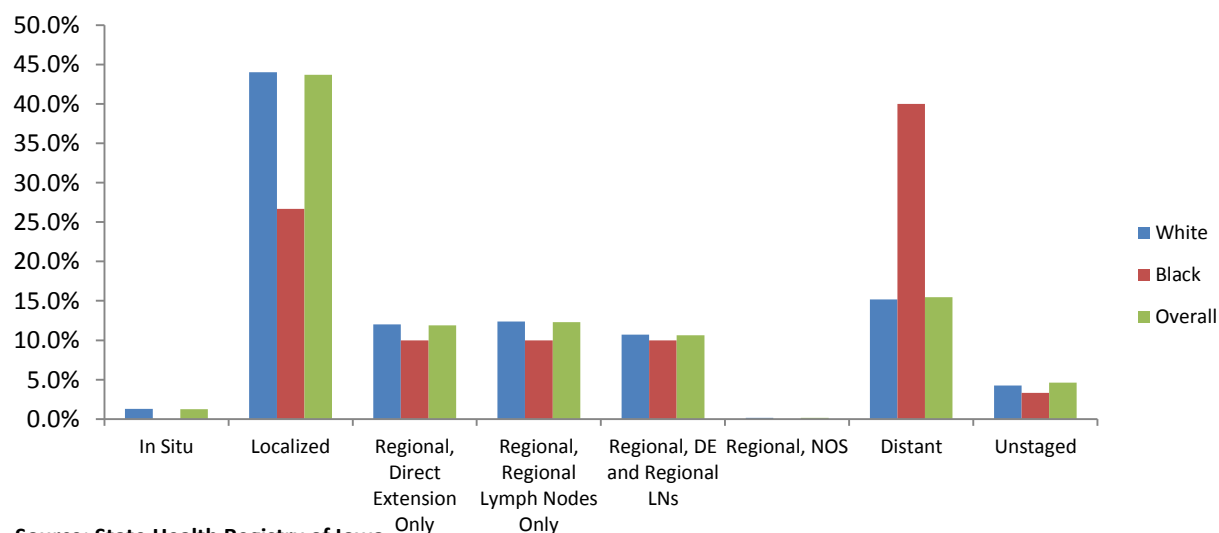


Source: State Health Registry of Iowa

Staging

Overall, more than 40% of all newly diagnosed colorectal cancers in Linn County are staged as “localized” and approximately 15% of all newly diagnosed colorectal cancers are staged as “distant”. This situation is flipped for the Black or African American population of Linn County, with only about 25% of colorectal cancers staged as “localized” and over 40% staged as “distant” in this population (Figure 48). This disparity combined with the almost doubled age-adjusted incidence rate in this population indicates a large gap in screening coverage for this population.

Figure 48: Colorectal cancer staging, Linn County, by race, 2000-2013



Source: State Health Registry of Iowa

Geospatial Analysis

The same metro areas of Cedar Rapids and the Northeastern rural portions of Linn County appear as areas of higher incidence in the colorectal cancer incidence density map; this can potentially be explained by the higher incidence rate of colorectal cancer in the Black or African American population as well as the higher rate among the older population. The large disparity of colorectal cancer incidence among the older and Black and African American populations of Linn County is closely mirrored by the map of colorectal incidence and again exemplifies the need for concentrated efforts in these communities. The rest of the incidence rate distribution map for colorectal cancer is similar to the overall cancer incidence distribution map with a large portion of the census tracts in Linn County experiencing a lower rate of colorectal cancer incidence (Figure 49).

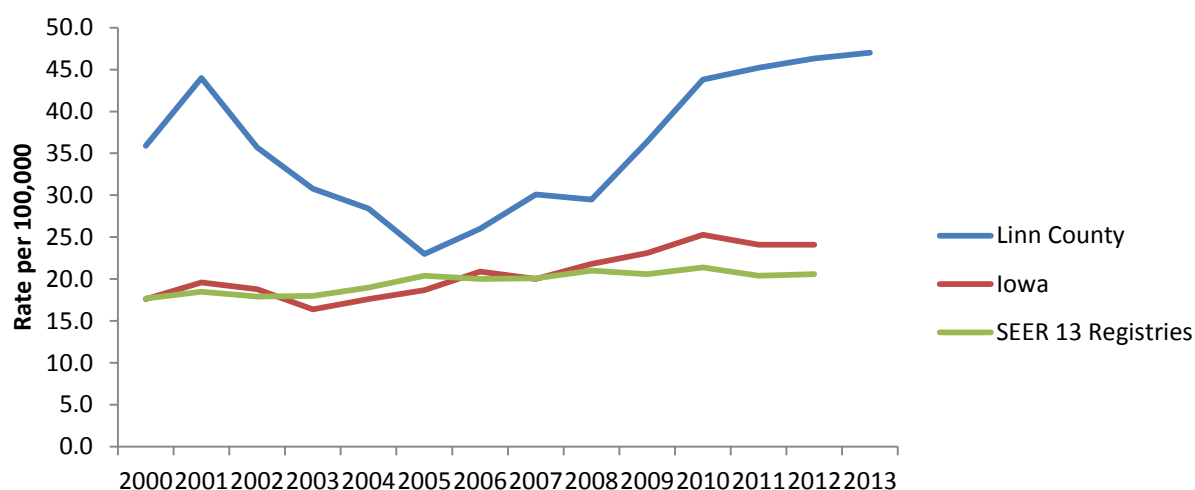
Skin

Trends

Unlike the other top 5 cancer types in Linn County that have either stayed relatively constant or been decreasing in incidence, skin cancer incidence is on the rise. Between 2000 and 2013 skin cancer incidence has risen by 31% in Linn County. In 2000, the age-adjusted incidence rate for skin cancer in Linn County was 35.9 per 100,000; the rate was 17.6 per 100,000 in Iowa and 17.7 per 100,000 nationally. Between the years 2001-2005, the rate in Linn County decreased rapidly to its lowest point in the past 14 years of 23.0 per 100,000, which translates to a statistically significant decrease of 48% between 2001 and 2005. Since 2005, that rate has jumped up to 47.0 per 100,000 in 2013, its highest point in the past 14 years. This increase in rate translates to a staggering 104% increase in skin cancer incidence between 2005 and 2013, which was a statistically significant change. While the incidence rate of skin cancer in Linn County has been rapidly increasing year to year since 2005 the rate nationally and at the state level has been rising more slowly only reaching 20.6 per 100,000 nationally and 24.1 per 100,000 at the state level in 2012, much lower than the rate in Linn County of 46.3 per 100,000 (Figure 50). The incidence rate in Linn County over the past 14 years has been consistently much higher than both the state and national rates. Skin cancer is the most common type of cancer in the United States, with the two most common types, basal and squamous cell carcinomas, being highly curable. Melanomas, which are the type most commonly tracked by state cancer registries, are the third most common skin cancer type and account for the majority of the deaths from skin cancer. Most commonly skin cancer is caused by exposure to UV light from sources such as the sun, tanning beds and heating lamps¹⁸.

¹⁸ Centers for Disease Control and Prevention. Skin Cancer. (2016, March 09). Retrieved March 14, 2016, from <http://www.cdc.gov/cancer/skin/statistics/index.htm>

Figure 50: Age-adjusted incidence rates, skin cancer, 2000-2013

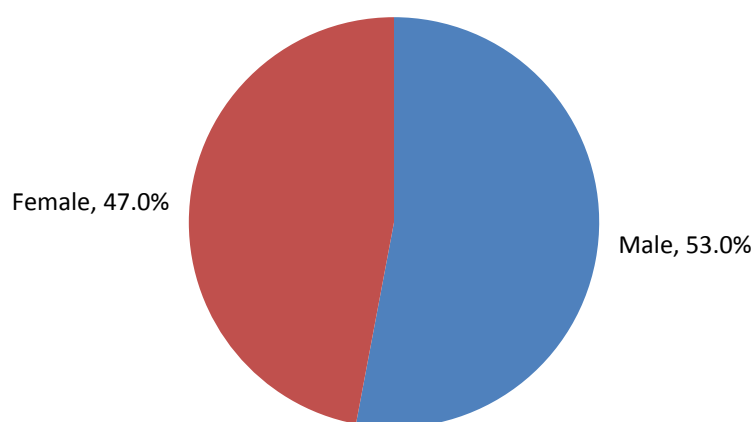


Source: State Health Registry of Iowa, National Cancer Institute

Sex

In Linn County, skin cancer affects women and men almost equally with 47% of all newly diagnosed skin cancer cases occurring in women and 53% occurring in men (Figure 51). Overall skin cancer is the fifth most common cancer type in Linn County and the fourth most common type of cancer when considering each sex separately (Figures 16-18).

Figure 51: Percent of newly diagnosed cancer cases, Linn County, skin cancer, by sex, 2000-2013



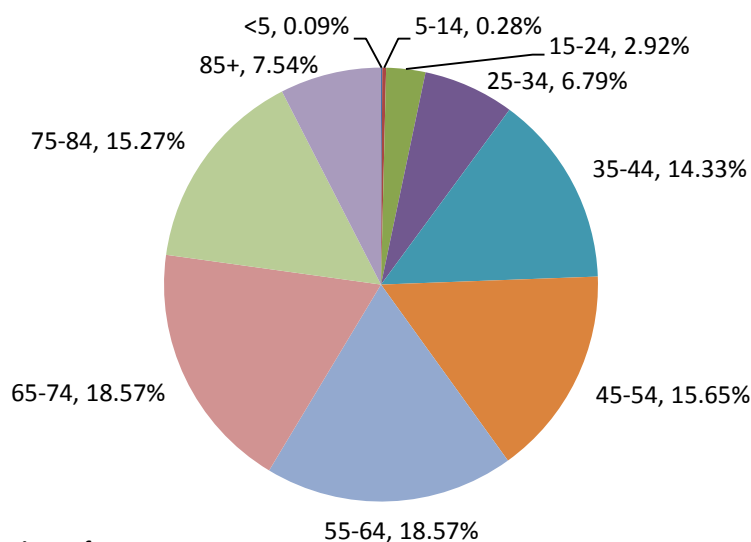
Source: State Health Registry of Iowa

Age

Skin cancer can affect any age, but is most common past the age of 35, with approximately 10% of all newly diagnosed skin cancers occurring in those aged 34 and younger (Figure 52). The incidence

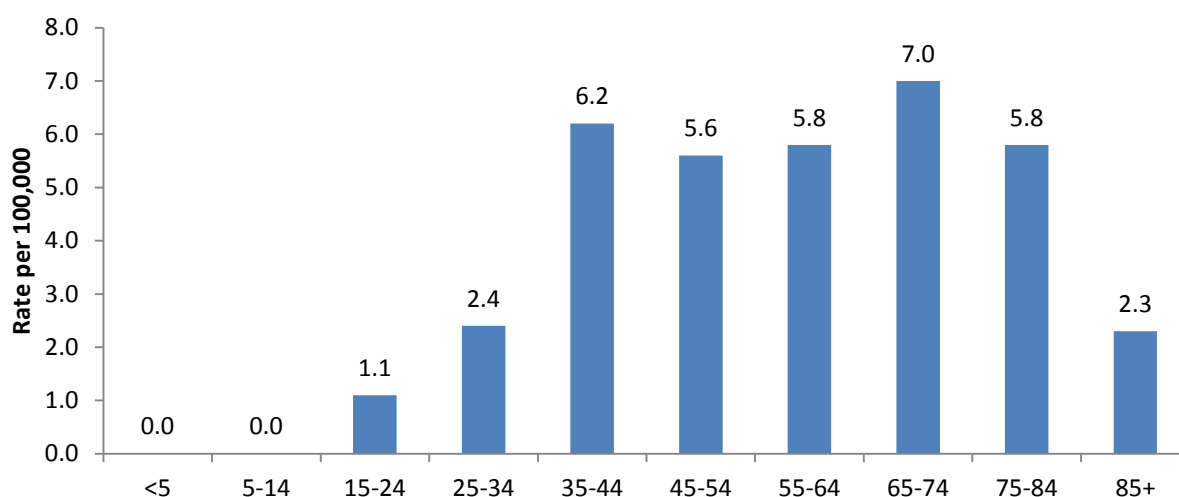
rate for skin cancer in Linn County stays consistent between the ages of 35-84, peaking in the age group of 65-74 year olds (Figure 53). Nationally the average age of skin cancer diagnosis is 63 years old¹⁹.

Figure 52: Percent of newly diagnosed cancer cases, Linn County, skin cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

Figure 53: Age-adjusted incidence rates, Linn County, skin cancer, by age group, 2000-2013



Source: State Health Registry of Iowa

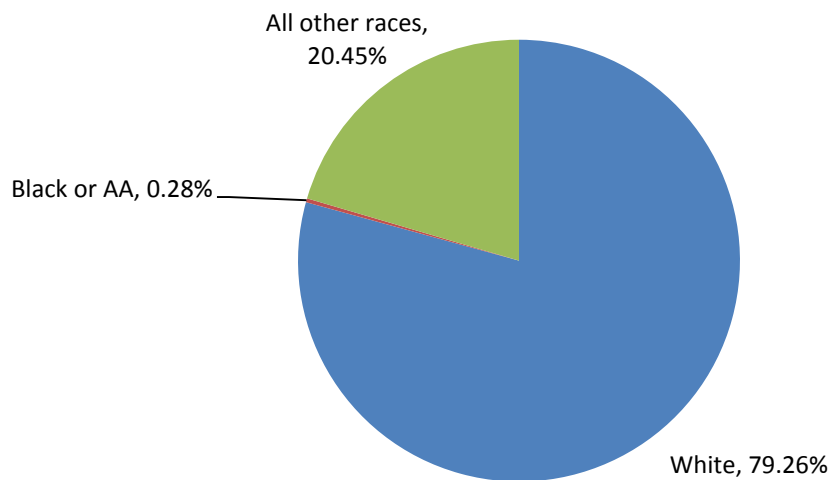
Race

Skin cancer is most common in people with a naturally lighter skin color. In Linn County, 79% of all newly diagnosed skin cancers occurred in the White population, <1% occurred in the Black or African American population and 20% in all other races combined (Figure 54). Between the years of 2009-2013,

¹⁹ Fast Stats: An interactive tool for access to SEER cancer statistics. Melanoma of the Skin. Surveillance Research Program, National Cancer Institute. <http://seer.cancer.gov/faststats>. (Accessed on 3-14-2016)

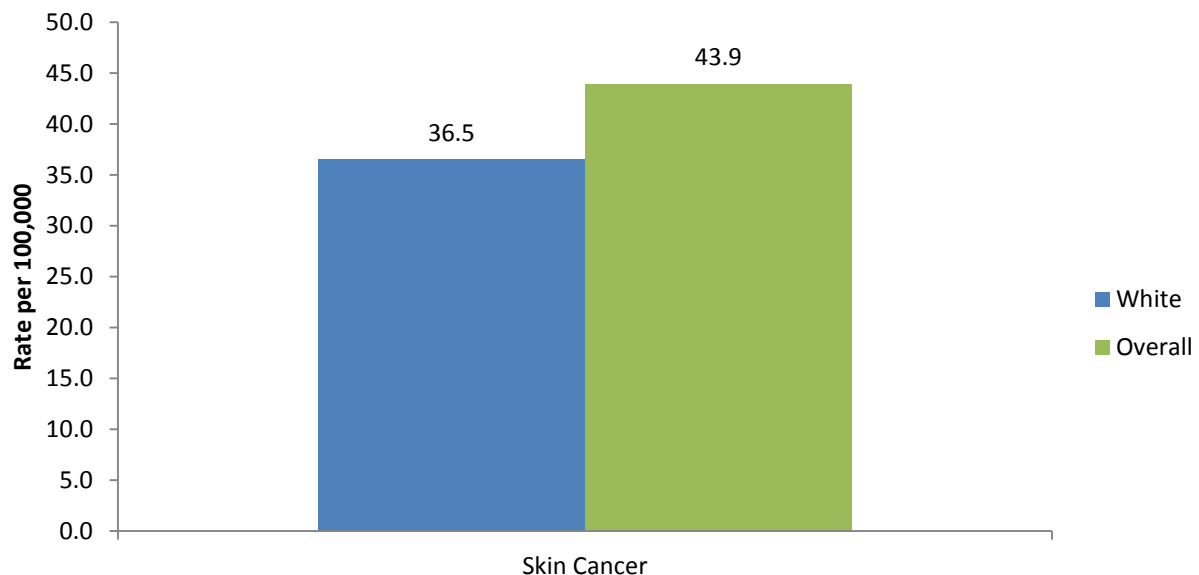
no new skin cancers were diagnosed in the Black population of Linn County. The age-adjusted incidence rate of skin cancer was 36.5 per 100,000 for the White population, which is lower than the overall age-adjusted incidence rate of 43.9 per 100,000 (Figure 55). This indicates that one or more of the other race populations in Linn County have an increased burden of skin cancer, but unfortunately due to data limitations it is not possible to determine which population it is.

Figure 54: Percent of newly diagnosed cancer cases, Linn County, skin cancer, by race, 2000-2013



Source: State Health Registry of Iowa

Figure 55: Age-adjusted incidence rates, Linn County, skin cancer, by race, 2009-2013

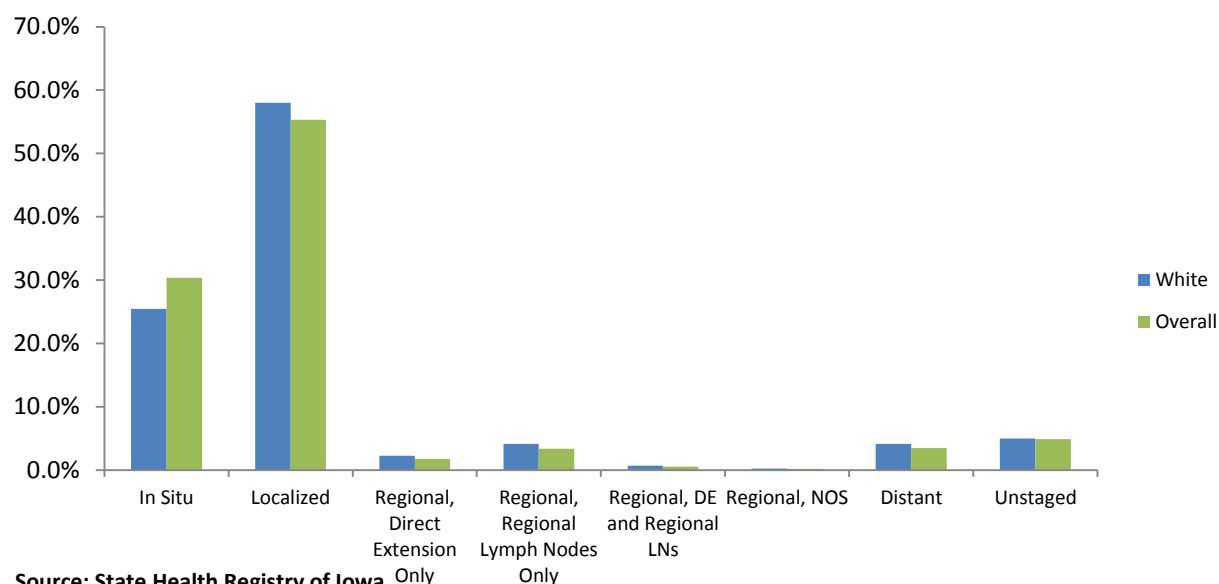


Source: State Health Registry of Iowa

Staging

Due to the low amount of diagnosed skin cancer in the Black and African American community the staging data for that race has been excluded from the staging summary. Overall, over 80% of all skin cancers in Linn County are staged as “in situ” or “localized” (Figure 56). The White population of Linn County mirrors this with the percent of cases staged as “in situ” or “localized” also exceeding 80%.

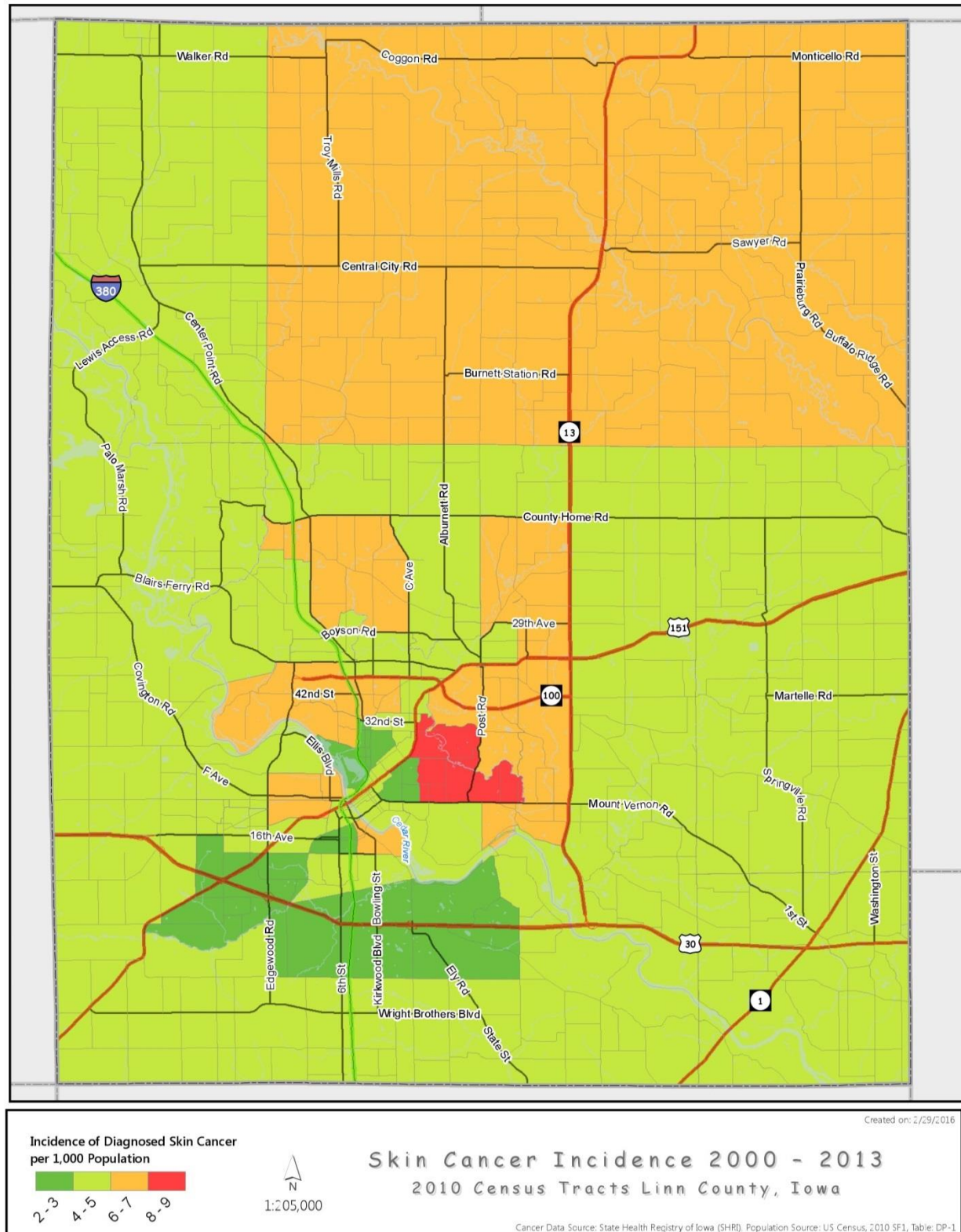
Figure 56: Skin cancer staging, Linn County, by race, 2000-2013



Geospatial Analysis

The distribution of skin cancer incidence in Linn County mirrors the distribution of the White population of Linn County. Census tracts with a predominantly White population experience higher incidence rates than areas with a larger proportion of Black and African Americans (Figure 11, 12 & 57). The Southern metro area of Cedar Rapids still experiences a higher incidence rate of skin cancer, similar to the other maps shown earlier, but the census tract that continually had high incidence rates in all of the previous cancer types is no longer an area with high incidence in this map, which could be contributed to the higher proportion of Black and African Americans in this tract.

Figure 57: Skin cancer incidence distribution in Linn County, IA, by census tract, 2000-2013, 2010 census



Credit: Peter Konrad, Linn County GIS

Recommendations

Overall, cancer incidence is improving in Linn County; however the average rates of cancer incidence continue to exceed that of both the state and the nation. While significant progress has been made in the last 14 years, there is still much room for improvement. Some areas of greatest need for improvement include addressing the increasing incidence of skin cancers, disproportionate rates of cancer incidence among the Black and African American population, the high amount of late stage colorectal and lung cancers and the consistent trend of above average cancer incidence in Linn County for nearly all cancer sites.

Skin cancer can be prevented through adherence to simple protection strategies, which may be relayed through continued community education. Continued education efforts should include information about the dangers of sun exposure, tanning beds and the importance of proper UV protection. Use of sunscreens and coverings, as well as increased education efforts in a variety of targeted settings may assist in curbing the drastic rise of skin cancer in Linn County. Education and training efforts should target children and adolescents within child-care, elementary school and middle school environments in order to foster lifelong adherence to sun protection. Education, training and incentive efforts for employers in rural and outdoor settings to provide proper sun protection for employees would also help to reduce sun exposure and decrease skin cancer incidence. Educational signage for skin protection practices in outdoor environments, such as recreational or metropolitan areas, may increase the education efforts of community outreach programs and would be a less invasive and less expensive practice for disseminating information to the public.

Proper screening and access to care can reduce cancer risk and reduce diagnoses of late stage cancers. Colorectal cancer and breast cancer is disproportionately diagnosed at later stages in the Black and African American population of Linn County. The age-adjusted incidence rates of prostate and lung cancer in this population are disproportionately increased as well. Increased efforts should be made to reduce these burdens. Increased access to screening services in underserved and predominantly Black and African American communities in Linn County, may reduce the incidence of late stage cancer in the Black and African American population. Community outreach, through one-on-one counselling with at risk individuals and providers as well as continued education efforts in at risk communities about the benefits of screening may also assist in reducing the high rate of cancer incidence and of late stage cancer diagnoses in the Black and African American population of Linn County. Increasing low cost screening options and reducing barriers to access for screening services should be done to ensure proper cancer screening in the Black and African American population as well as other at risk populations in Linn County. Smoking cessation efforts, through increased access to smoking cessation options (such as nicotine replacement therapies), education, smoking cessation support groups, and increased second-hand smoke controls should be made more readily available in at risk communities, which may reduce the large burden of high lung cancer incidence within the Black and African American population of Linn County.

A healthy lifestyle and adequate access to care are two primary factors that determine a person's lifetime risk of developing cancer. Continued community outreach, promotion of behavioral

changes, ensured access to healthy food options and ensured access to safe exercise are all efforts that should be made to help reduce overall cancer incidence in Linn County through improving the overall health of the populous. Continued and renewed efforts to promote proper screening for all cancer types, in all communities, with a specific focus on colorectal, lung, breast and prostate cancers, may help to drastically reduce the diagnosis of late stage cancers and prevent cancer deaths in Linn County. Increased access to screening, education efforts, smoking cessation programs and decreased barriers to care should be implemented to reduce the burden of cancer in Linn County as well. This report highlights an immense opportunity to implement new programs and improve current efforts to reduce cancer incidence and mortality in Linn County.

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